THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXIII. No. 580.] LONDON, JUNE 23, 1874. [26TH YEAR.] Price 6d.

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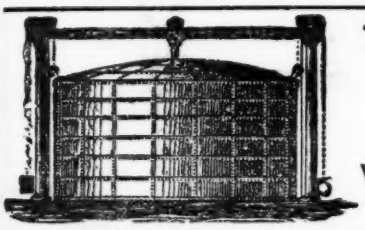

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The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.

1862.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

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This Paint having been in general use over twelve years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints for which purpose it is superior to White Lead.

SPECIAL DRIERS FOR ANTIMONY PAINT SUPPLIED.

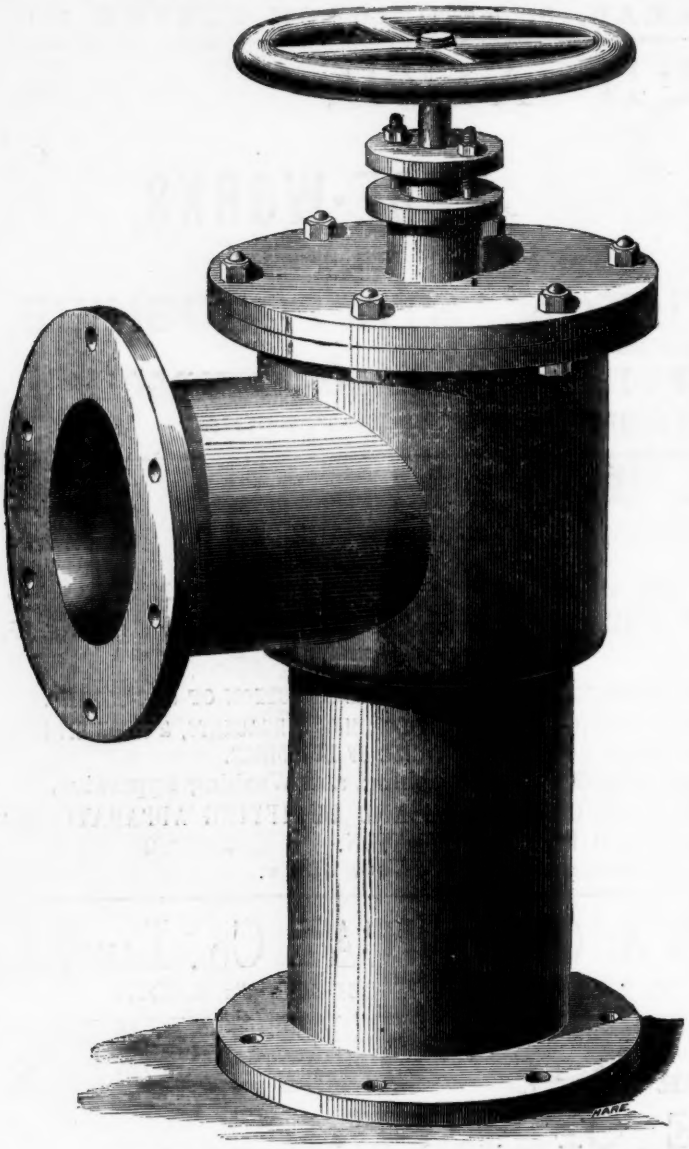
GEORGE WALLER & CO.,

GAS ENGINEERS AND CONTRACTORS,

MANUFACTURERS OF

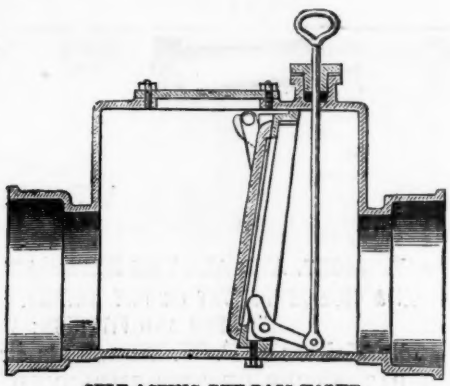
BEALE'S IMPROVED PATENT GAS-EXHAUSTERS,

COMBINED ENGINES AND EXHAUSTERS.

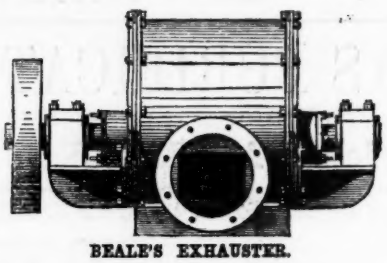


DISC GAS-VALVE.

These Valves have been specially designed by G. Waller and Co. for Beale's Exhausters. They are most effective in action, and have given universal satisfaction. They can also be made with spigot at base, to suit ordinary socket connexions.



SELF-ACTING BYE-PASS VALVE.



BEALE'S EXHAUSTER.

PUMPS, VALVES (2 in. to 30 in.), HYDRAULIC REGULATORS, ENGINES, &c., in STOCK.

PHŒNIX ENGINEERING WORKS, HOLLAND STREET, SOUTHWARK, S.E.,

AND AT

STROUD, GLOUCESTERSHIRE.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

WILLEY AND FORD,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.

NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

PATTERN-BOOKS and PRICE LISTS furnished.

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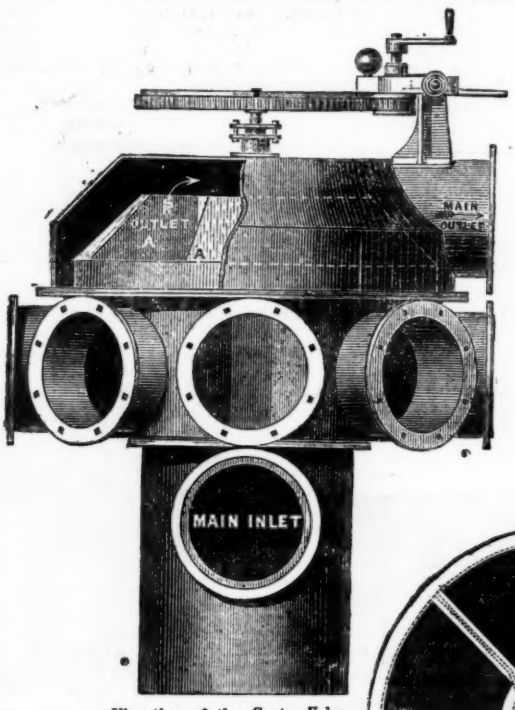
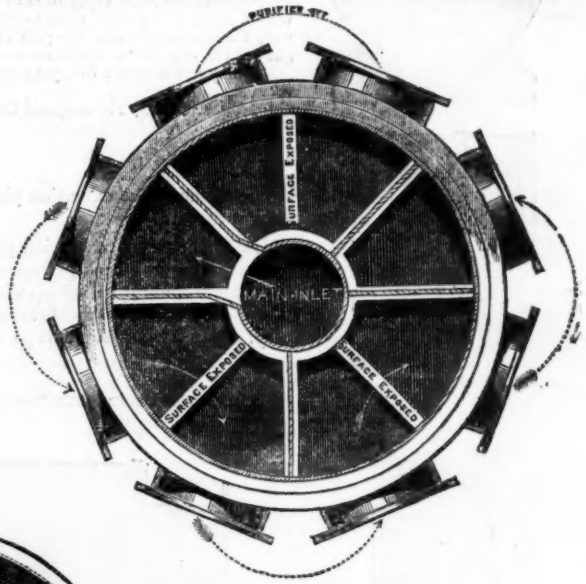
GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

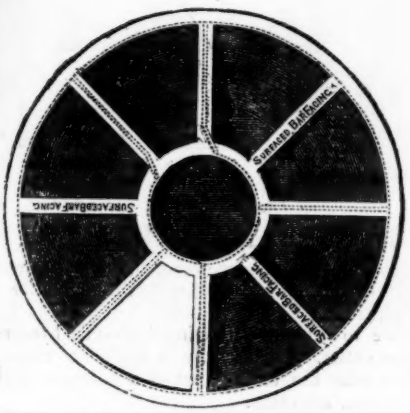
C. & W. WALKERS' PATENT CENTRE-VALVES.



Elevation of the Centre-Valve for four Purifiers. The safety cover is shown broken, to enable the Valve itself, which is inside, to be seen.



Plan of the Body, showing the Valve lying in it, with three of the facings, which were formerly exposed to settlements of dirt, carbon, naphthaline, &c., but which are now always covered by the surfaced bar-facings of the Valve. (See below.)



Plan of the Valve, or upper portion, showing the surfaced bar-facings referred to above.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A very considerable improvement and saving is effected in the cost of the connecting-pipes.

FOUR-WAY CENTRE-VALVES FORMING INLET, OUTLET, AND BYE-PASS.

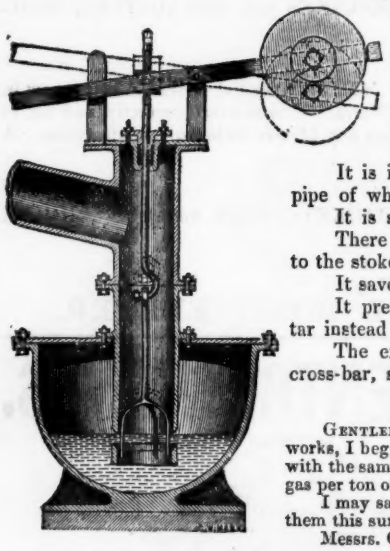
MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

CAFFALL, THOMAS, & CO., LIMITED.

PATENT IMPROVED SEAL

FOR

GAS HYDRAULIC MAINS.



It relieves the retorts from all pressure during the time gas is being made.

The end of the dip-pipe not being immersed in the tar, permits the gas to pass freely, and without pressure, from the retort into the hydraulic main.

The dip-pipe can be effectually sealed without trouble, to resist the back rush of gas, *to any possible pressure*, during the time of charging; but in the event of the Seal being left on, after the retort is closed, no inconvenience is caused, as the piece of pipe used as the Seal only lengthens it to an ordinary dip-pipe.

It is inexpensive, and can be easily and readily applied to any existing hydraulic main and dip-pipe of whatever shape or size, at a trifling cost.

It is simple in its arrangement, and cannot get out of order.

There is no deposit of carbon on the top of the retort, thereby saving considerable time and trouble to the stokers when drawing and charging, also the injury caused by scurfing the retort is avoided.

It saves 10 per cent. of the coal carbonized; also the same proportion of fuel, retorts, labour, &c.

It prevents the thickening of the tar in the hydraulic main, as the heated gas passes *over* the tar instead of being forced *through* it.

The extension piece of pipe is moved by a lever, from which hangs a $\frac{3}{8}$-inch rod, hooked on the cross-bar, so that the lid of the retort cannot be struck without first sealing the pipe.

Alton Gas and Coke Company, Alton, Hants, April 25, 1874.

GENTLEMEN,—In reply to your inquiry respecting your Patent Dip for Hydraulic Gas-Mains in use at these works, I beg to say that, upon looking into our carbonizing account for the last 12 weeks, and comparing the result with the same quarters of the past five years, I find that your Dip has given our Company an increase of 1286 feet of gas per ton of coals beyond the make in the other years, notwithstanding the retorts have been in use for three years.

I may say that our Company are so satisfied with the Dips that it is intended to fit up the other retorts with them this summer.

I am, gentlemen, your obedient servant,

Messrs. Caffall, Thomas, and Co., Limited, 28, Gracechurch Street. WM. TRIMMING, Secretary.

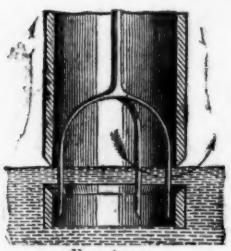


FIG. A.

Figure A shows the extension piece lowered to permit the gas to pass out of the dip-pipe without pressure.

Figure B shows the extension piece raised against the end of the dip-pipe, thereby preventing any back passage of the gas during the time of drawing and charging; and should it be left up while the gas is being made, no inconvenience is caused, *nor danger of bursting the retorts incurred; it being an open pipe and not a solid plug*, the gas will pass under as with the usual dip-pipe.

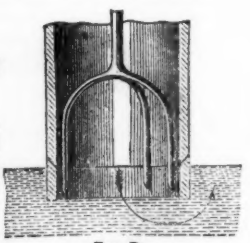


FIG. B.

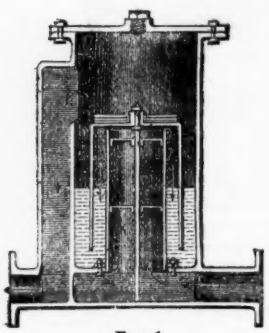


FIG. 1.

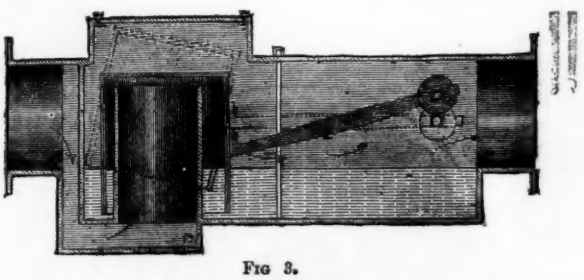


FIG 3.

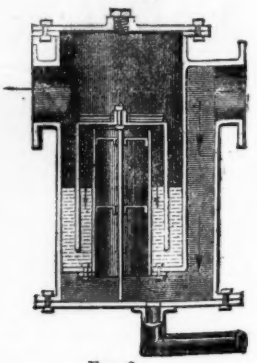


FIG. 2.

BYE-PASS FOR EXHAUSTER (Fig. 1).

This Hydraulic Bye-Pass has been invented for the purpose of supplying to gas companies a cheap, effective, and self-acting valve. It is simple in its construction, cannot get out of order, perfect in its action, can be made to stand any pressure, occupies very little space, and can be adapted to any existing pipes.

Fig. 2 is a Valve similar to Fig. 1, but made to act as a self-acting hydraulic bye-pass for washers, condensers, scrubbers, and meters; the Valve part being *below* the inlet and outlet, so that it may be applied to underground mains. Both Valves can be fitted to existing mains without disturbing them, more than the cutting out of a sufficient length to permit the fitting in of the Valve; after being properly fitted, they will require no further attention.

SELF-ACTING HYDRAULIC SAFETY-VALVE (Fig. 3),

For preventing the back flow of gas from the gasholder, and thereby preventing the possibility of accidents (the great damage and danger to life and property resulting therefrom) through the breaking of pipes, unsealing of purifiers, or any other cause. It is easy and prompt in its action, for upon the forward pressure of the gas ceasing, the bonnet *instantly* closes over the stand-pipe, thereby effectually preventing any return of the gas; no extra pressure is put upon any part of the works by its use, and it can be made to stand any required pressure.

Every information can be obtained, and Models seen, at the Offices of the Company,

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LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

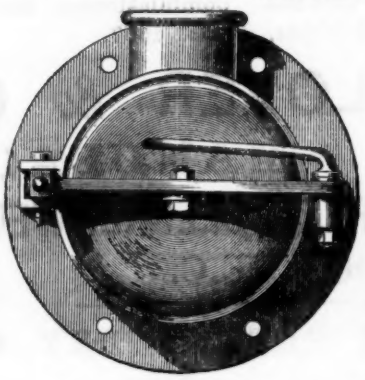
HOLMAN'S PATENT ECCENTRIC FASTENINGS & ANTI-FRICTION CATCHES.

OVER 10,000 IN USE.

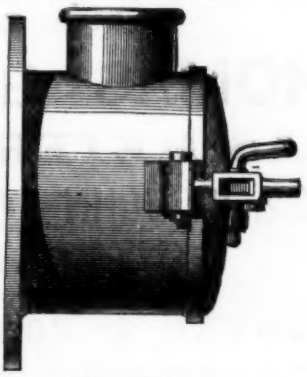
NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



FRONT VIEW.



SIDE VIEW.

SIMPLE.

ECONOMICAL.

DURABLE.

EFFECTIVE.

NO DUPLICATE LIDS REQUIRED.

These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

These Lids are Adopted by the following (among many other) Gas Companies:—

The Gaslight Company, Beckton (where over 2000 are in use).	The West Ham Gas Company.	The Salford Corporation Gas-Works.	The Carmarthen Gas-Works.
„ Gaslight Company, Bow Common.	„ Imperial Gaslight Company.	„ Rochdale Corporation Gas-Works.	„ Merthyr Tydfl. Gas-Works.
„ London Gaslight Company.	„ Gas-Works, Arsenal, Woolwich.	„ Liverpool United Gas-Works.	„ Ystrad Gas-Works.
„ Independent Gaslight Company.	„ Commercial Gas Company.	„ Birkenhead Gas-Works.	„ St. Alban's Gas-Works.
„ Phœnix Gaslight Company.	„ Alliance and Dublin Gas-Works.	„ Birmingham Gas-Works.	„ Over Darwen Gas-Works.
„ South Metropolitan Gaslight Co.	„ Edinburgh Gas-Works.	„ Nottingham Gas-Works.	„ Aylesbury Gas-Works.
	„ Manchester Corporatn. Gas-Works.	„ Newcastle-on-Tyne Gas-Works.	„ Cardiff Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

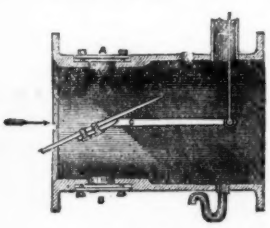
The following important Testimonial, among others, has been given:—

"*The Gaslight and Coke Company. Engineer's Office*, 6, *Westminster Chambers*, *Nov.* 14, 1871.

"Dear Sir,—In reply to your inquiry, I have the pleasure of stating that the whole of the Mouthpieces at Beckton have Morton's Lids attached to them and they have given us every satisfaction. We have 2160 in use.—I remain, yours truly, (Signed) "F. J. EVANS."

SOLE MAKERS OF

HUNT'S PATENT EQUILIBRIUM GAS GOVERNOR.



In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—i.e., it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

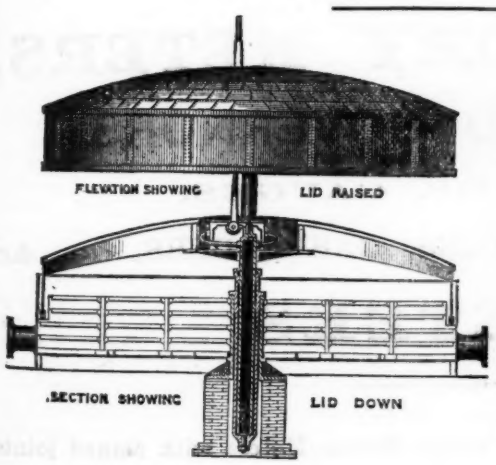
The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by several leading Gas Companies, among whom are the following:—

The Gaslight Company—a 24 in. at Whitechapel District Station.	The Gaslight Company—a 6 in. at the Gas-Works, Beckton.
„ „ a 36 in. at Goswell Road Station.	The London Gas Company—an 18 in. at the Gas-Works, Nine Elms.
„ „ a 24 in. at „ „	„ „ an 8 in. at „ „
„ „ a 24 in. at the Gas-Works, Beckton.	„ „ a 24 in. at „ „

Also at the Gas-Works, Rochdale, Monmouth, Devonport, Cannes, and Mentone (France), &c.



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DIRECT HYDRAULIC LIFT

FOR PURIFIER LIDS

REQUIRES NO TRAVELLERS, CRANES, CHAINS, OR OTHER GEAR.

SAFE, SIMPLE, AND DURABLE.

ANY SIZE LID MAY BE RAISED BY ONE MAN.

Eight Hydraulic Lifts have been applied at Beckton Gas-Works to raise the Covers of the large Check Purifiers, which are 40 feet diameter, during the past three years, with perfect success.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

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DRY GAS-METER MANUFACTURERS,

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THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th. May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JUNE 23, 1874.

Circular to Gas Companies.

THE committee of the Gas and Water Companies Association, headed by Mr. W. H. Michael, have had an interview with the Home Secretary, in order to express the views of the association in the prospect of the introduction of an amended Municipal Corporations (Borough Funds) Bill. It will be seen that, to some extent, the association fall in with the opinions of Sir Joseph Heron's party. They would relieve Corporations from the necessity of applying to the ratepayers for permission to expend public money in promoting Bills relating to gas and water undertakings of which they are actually possessed. The disastrous operation of the Act at Liverpool may, perhaps, be taken as a proof that an amendment of the Bill to the extent proposed is advisable. The result at Liverpool, however, must, we think, be taken as a protest against more stringent water regulations and the stinting of water, rather than opposition to the expenditure of money. It is likely that the ratepayers have since repented of their decision, and in another year will be glad to reverse it. We must confess, on our own part, that we hesitate to go so far as the Gas and Water Companies Association. We have grave doubts of the propriety of removing any single check which exists on the expenditure of money by Corporations. The Association of Municipal Officers and others, we see, have taken alarm at the nomination of a Select Committee of the House of Commons "to consider and report on the appointment and duties "of assessors and auditors in boroughs." It is feared that the committee may report in favour of a Government audit, and surcharging members of Corporations, and this is regarded as inconsistent with the principles of self-government. We have no doubt that Mr. Tweed, of New York, would have held precisely the same opinion. Nevertheless, it would have been well for that city if a Government officer had looked into the accounts of its Corporation.

On another point the Companies Association make a concession: they would allow local authorities to oppose a Bill without the concurrence of the ratepayers. The committee, however, would prefer that the law should remain as it is; and so would we. If any alteration were made, we would rather see the freer admission of a *locus standi* for private petitioners against Bills.

On the most important point in connexion with the Act in dispute we are bound to say that the Companies Association are firm and decided in their opposition to any change. They ask that the proviso which forbids any governing body from promoting any Bill for the establishment of gas and water works, to compete with statutory undertakings, may be retained. The reasonableness of the grounds on which this request is made cannot be contested. Governing bodies may purchase undertakings if they like and if they can; but the important principle "that public "money raised by the taxation of ratepayers shall not be brought "into competition with money raised by private enterprise" must be maintained. No gas or water company could stand such competition, and we are certain that Parliament will not allow it. The last point referred to was the promotion of Bills for the compulsory purchase of undertakings, statutory or private. On this the association contended that the voice of the ratepayers should be heard. It is a well-known fact that the opposition to gas and water companies by local authorities often arises from the spite and malice of one or two influential men on the Board or Council. The wishes of the ratepayers may be strongly opposed to the designs of these men; but, loud-voiced or rich, they rule in the Council, and without the protection asked, the interests of both company and ratepayers might be sacrificed at their bidding. The Home Secretary does not intend to deal with the measure this session. He seems to see the importance of the question as between corporations and ratepayers, but in his reply to the deputation we have but a faint foreshadowing of his intentions, and we shall not attempt to make them clearer. We hope that the Companies Association will keep their attention fixed on a measure of such vital interest to gas and water companies, and scarcely less so to ratepayers.

While on parliamentary matters, we may just mention that Mr., or Major, or Colonel Beresford's confiscation Bill has fallen through for this year. The Examiners reported Standing Orders not complied with, and the Standing Orders Committee decided that they ought not to be dispensed with; and so disappears the worthy gentleman's first attempt at legislation. Considering the treatment his effort received in quarters where he might have expected to find some support, we shall be surprised if he reintroduces the measure. The fact, we have no doubt is, that, after all that is said and done, intelligent Londoners are well contented with their water supply, as indeed they have reason to be. It is sufficient in quantity, admirable in quality, and not dear; and, notwithstanding all the efforts of the agitators, the people are satisfied. The time, we are certain, will come when, after reflection, they will be equally well satisfied with the gas supply. It will not be while so much disparity in prices rules; but the tendency of the future must be towards an equalization of rates, as there is now practically of quality. A perfect equalization of prices is not to be expected, but, under favourable circumstances, the widest differences will disappear.

The consideration of Mr. Fowler's motion by the Metropolitan Board of Works has been again postponed. It is to this effect—that the main inducements to economy and good management on the part of the gas companies have been taken away, and that, to obtain a fixed rate of income, the companies are permitted to tax the consumers to an unlimited extent; hence he wishes it to be referred to the Works and General Purposes Committee, to consider and report what steps should be taken either to afford an independent supply of gas in the metropolis, or to initiate some legislative measures to protect the interests of the consumers. We think it highly desirable that this question should be discussed by the Board. We have every belief in the honesty of their intentions, and there are some very able men amongst the members. The solution of a question is often found outside the circle most immediately concerned with the results; and if the Board will show us how to sell gas cheap, and make guaranteed interest on expended capital, we shall be infinitely obliged to them. If they should decide on taking up a position of hostility to us, we are, of course, quite prepared to meet them.

In the management of a corporate gas undertaking, the Dundee Commissioners are not to be excelled. It must be remembered that this undertaking exists for the benefit of consumers, and cannot be used as a means of taxing one section of the community for the benefit of the rest. All surplus profits go in reduction of price, as they ought to do with all corporate undertakings. Every year the commissioners produce a sort of budget, in which the expenditure and revenue for the year are estimated. With what care these estimates are prepared in Dundee may be judged of by the statements made at a meeting of the

commissioners a few days ago. It seems that the estimated revenue for the past year was £67,864 0s. 8d., while the actual amount received was £67,864 2s., or exactly 1s. 4d. more than the estimate. The estimated expenditure was £67,822 12s. 5d., and the actual sum expended £67,850 14s., only £28 1s. 8d. beyond the sum stated. For the present year, the price of gas being reduced 4d. per 1000 feet, the revenue estimated is £66,574 14s. 6d.; and the expenditure £66,357 17s. 6d. showing a probable surplus of £189 17s. 0d., which we fervently hope the commissioners will realize. The reduction of 4d. per 1000 is a saving of £3700 to consumers in Dundee. The works, under the superintendence of their excellent manager, Mr. Macrae, appear to be in good condition. Leakage seems to be large, but it is being gradually reduced. The gas-rate looks high, 5s. 8d. being the reduced price; but it must be remembered that 28-candle gas is supplied, much of the luminosity of which is, no doubt, wasted at Dundee, as elsewhere in Scotland, where such rich gas is furnished. If all corporate gas undertakings were managed like that at Dundee, we should look with much less disfavour on the absorption of companies by local authorities.

We commence to-day the publication of the papers read at the meeting of the British Association of Gas Managers. The first, by Mr. Warner, on "Wet Meters," will, we hope, be carefully perused by others than gas managers. The history of the development of the meter, until it has become a perfect instrument as regards measurement and delivery, will be read with interest by everybody. In continuation of his papers, Mr. Warner will, we hope, say something of the registering apparatus, respecting which, our readers will remember, the Warden of the Standards has made some important observations (see his fourth report), which deserve an independent notice. In the meantime, it may calm the irritability of the consumers here in London, and at Newcastle and elsewhere, when they learn that the meter of the present time is so constructed as to afford absolute protection to the consumer against overcharge. We know how easily it can be made to measure against the company, and we agree with the president that there is a necessity that something should be devised to protect the gas company from getting less than they ought to do for the quantity of gas consumed.

Mr. Douglas's paper on "Gasholder-Tanks in Concrete" is of immense practical interest, involving, as a concrete tank appears to do, a very large saving. The subject was so fully and so well discussed that there is little for us to say. The essentials for success in such a construction we believe to be, first, a good foundation; then the employment of the very best Portland cement, not stinted in quantity, with "material" not too large in size, and angular rather than rounded. With these, we believe with Mr. G. Anderson, an impervious tank may be made without "rendering;" but a well-trowelled surface is an undoubted protection. A good deal might be said respecting the importance of experienced manipulation. Until men are better educated for this kind of work they will require close watching. We may take an exception to the reply of Mr. Douglas to a question put by Mr. Bates as to the action of frost on a concrete tank above ground. If such a tank is pervious, it will take up more water than is necessary for the setting of the cement, and this water will be likely to freeze and cause the wall to crack. Major Scott's cement, we may say, is altogether inapplicable in the construction of a tank. The question as to the necessity for puddling is a nice one, and must, we think, be decided by circumstances. We need say nothing to impress on our readers the necessity for a sound tank, but the state of things at Biggleswade now offers an example. The gas company there have been much harassed for the last 12 months by claims for compensation made by owners of property near the works, for injury done to their wells by leakage. They are doing their utmost to remove any cause of complaint, and endeavouring to settle the various claims without litigation. These praiseworthy efforts, however, have not been so successful as they deserved, and another suit has been commenced for five penalties of £200 each. The cause of these proceedings we may assume is a leaky holder-tank.

In compliance with the wishes of several valued correspondents, we propose to start a column of "Notes and Queries," as a means by which our readers may communicate much valuable instruction one to another. It can seldom happen with us—as is sometimes the case in other scientific periodicals which devote space for a similar purpose—that the question put is designed to elicit the means of making a fortune. Questions like those put by our correspondent last week are only intended to obtain information from more experienced readers on practical points, and as such we are certain they will receive the attention and consideration asked for by another correspondent this week.

The British Association of Gas Managers has been the fertile parent of several similar societies; first, a German "Gesellschaft," then an American "Association," and now a second French society, the "Société Technique de l'Industrie du Gaz." We shall soon begin the publication of papers read at the recent meeting of the American Association. Our Paris correspondent is certain to keep us well informed of all that goes on in the French Society. The programme offered is not remarkable. There will be first an account of various questions interesting to our industry; then a communication on "Mechanical Stoking;" afterwards a paper by M. Albert Ellissen, an able gas engineer known to many English managers, on "Condensation Processes," and subsequently a paper by M. Rouget, on "Meters." All these papers we expect that our able Paris correspondent will give us the opportunity of reporting.

The case of the Air Gaslight Company was again before the Court of Chancery last Saturday, on two petitions to wind up. The matter has stood over for some time to await the result of an inquiry, by a shareholders committee of investigation, into the merits of the invention and the value of the property of the company. On behalf of the new directors it was now urged by their counsel that the petitions should be dismissed, and it was stated that the committee were still prosecuting their researches. A report had been made by certain members of the committee to the effect that they had consulted Professor Wills and Mr. Pritchard, on the subject of the patents, whose conclusions generally were, that there was no doubt air gas could be produced which was free from the ordinary impurities of coal gas, and was capable, under suitable circumstances, of successful application, but that in no case would it be possible for any such process to compete with coal gas, and they believed it would only be available where expense was a secondary consideration. The committee however, have since discovered that another patent has been taken out by Mr. Harrison, to which the company are entitled, the value of which they want an opportunity for testing, and it seems they still cling to the hope that, though the report of Messrs. Wills and Pritchard is not as encouraging as could be desired, the process may yet be profitably worked; and they state that the patentee has renounced his claim to receive a dividend on his £65,000 worth of shares until the other shareholders have received 10 per cent. The Vice-Chancellor remarked that what he had required on the last occasion—viz., a statement of the financial position of the company—was not forthcoming, and he adjourned the further hearing of the case until the report of Messrs. Wills and Pritchard could be submitted to a meeting of shareholders, and their opinion expressed thereon. We reserve report of the proceedings before the Vice-Chancellor till our next.

WATER AND SANITARY NOTES.

"The drought still continues" may, unhappily, stand as the stereotyped introduction to these notes. We alluded a fortnight ago to the scarcity of water at Newcastle, where much inconvenience is caused by the limited supply. The North Shields Company have also been compelled to lessen the quantity distributed. Their reservoirs are said to be nearly dry, but they are getting a fair supply from a new shaft, and our correspondent states that they are likely to get more from some new pits which are being opened. At Alfreton it is said that hundreds of families are now almost without water, either for domestic or other purposes; which means, we presume, that the wells in the place are nearly dry. The property owners, it seems, have opposed the Local Board of Health in their efforts to provide water-works, and their tenants now suffer for the obstinacy and meanness of their landlords. Fever, it is said, has raged in the town for months. At Ossett an extreme scarcity of water exists, and the Local Board have forbidden the use of the public supply for any other than purely domestic purposes. At Merthyr there is said to be about three weeks supply in the reservoirs, and the inhabitants are in much alarm at the prospect. In the meantime, it may be noticed that, according to the Registrar-General's weekly return, the large towns of England—some of them submitted to a restricted supply of water—are in a singularly healthy state. There can be no doubt that atmospheric conditions have much more influence on the general health than anything else, and a dry atmosphere would seem to best suit the constitution of Englishmen.

We notice that a memorial from the Council of the Social Science Association—another busy body which, so far as we know, have never done the least good—has been presented to the President of the Local Government Board, praying for the periodical publication of analyses of the air and water of towns having a high density of population, for the *purpose of detecting disease*, and suggesting what may be needful for the protection of public health and the prevention of the spread of contagious diseases. We should not be sorry to see the suggestion carried out if the operations be entrusted to a different person in each town. We should strongly object to the appointment of a central analyst, who would

get the opportunity of forcing his own peculiar fancies upon the public mind, so practically suppressing independent inquiry. We are not clear as to how an analysis of air and water is to *detect disease*, or even to suggest what is needful for the prevention of the spread of disease; but of course the Council of the Social Science Association know all about it. Let us have, if any, independent returns from every town, and if we get nothing more, we shall probably find amusement in comparing the reports.

Some of our readers will have noticed that another adulteration committee is now sitting; we forget how many have sat before. The evidence presented this time is rather astonishing the chairman of the committee. Between one chemist, who asserts that he can detect any adulteration in butter, and another who says that he can make a purely artificial butter, which every other analyst shall certify to be perfectly genuine, the chairman gets befogged, and naturally so. It may be granted that butter is largely mixed with wholesome fats—adulterated if you like. We do not believe in the disgusting mixtures said to be sold, simply because we know they would be unsaleable. The point, however, we would put for the consideration of Mr. Reader is this—Where is the amount of genuine butter required to supply the demand in this country to come from? This demand increases every year. Each individual in the United Kingdom is calculated to have eaten 1¾ lbs. of imported butter in 1857, and nearly 4¾ lbs. in 1871. The price of the genuine article has just about doubled in 25 years, and goes on steadily rising; but cows increase in number very slowly, and we doubt whether they exist in sufficient number, within easy reach, to supply us with the butter we want, after having supplied their home requirements. The British matron will have butter. It is of no use to offer her "butterine," or "margarine," or any other wholesome and palatable substitute. She rejects them with scorn, and will have butter—or what is sold as such.

The British father, too, will have wine, and European wine. He does not reflect that the vines do not exist necessary to produce anything like the quantity sold and drunk. He wants wine, and, moreover, he wants it cheap; and to our minds he ought to be thankful to the people who produce him such excellent imitations. They are not always disguised, for a short time ago, at a first-class London hotel (limited company) we met with a bottle of champagne honestly labelled "à glucose." It is forty years ago, we rather think, since Captain Basil Hall calculated that all the vines in the Champagne district would not produce the quantity of the wine drunk under that name in New York alone. We have no space to-day to refer to other adulterations; but may return to the subject as the evidence proceeds, and endeavour to find some guidance to the construction of a workable Adulteration Act.

THE NATIVE GUANO COMPANY.

In our last number we promised full details in regard to the history, progress, and apparent fall of the Native Guano Company. The company was originally formed to work a patent taken out in 1868, by Messrs. Sillar and Wigner, for the employment of a mixture of alum, blood, and clay for the precipitation of sewage, the initials letters of the materials employed giving the title to the process (A. B. C.). The introduction of blood was the act of a religious enthusiast, who justified its use by alleging the cleansing efficacy attributed to blood in the Old Testament Scriptures.

The ingredients included in the patent of 1868, with the exception of clay, alum, crude sulphate of alumina or alum, and charcoal, have either been disused or disowned. The subsequent formulæ have been altered *ad infinitum*. The last adopted has already been given in our issue of April 21, at page 545 *ante*.

The early experiments were conducted at Tottenham and Leicester, and at last a company was formed. The first actual commercial operations were carried out at Leamington, Warwickshire, and here began a series of misfortunes which might well have utterly discouraged all ordinary men. The mechanical arrangements were wretchedly defective. The drying methods were equally so; and, consequently, the company had difficulties to contend with which were all but insuperable. Their undried mud accumulated, and caused an unbearable stench at a place which is, perhaps, one of the most fashionable resorts of English tourists. The Local Board and the press were aroused, and on each alternate Tuesday fresh battles had to be fought. Some of the inhabitants had to complain to the Government, and, subsequently, the Royal Commission on Rivers Pollution strongly condemned the whole affair.

Meanwhile works were commenced at Hastings—nominally by the Hastings Sewage Manure Company, Limited, but really by the Native Guano Company. The buildings were erected in great haste, and, consequently, a general failure took place when operations commenced. Temporarily this was got over, but a lamentable accident, by which three lives were lost, stopped all the works for a long time. Subsequently the centrifugal machines which had been used for partially drying the manure failed. Steam drying was tried. The *finale*, however, is simply this, that the Hastings Company are before the Master of the Rolls, in course of being now wound up.

The company had meanwhile made arrangements with the Corporations of Leeds and Bolton, and works were commenced at both towns. In both cases great delay occurred, many breakdowns and failures, but at last both were got to work. At Leeds the effluent was excellent, and frequently presenting an appearance far better than the Thames at Teddington or Hampton Court, although the sewage was as black as ink and abominably fœtid. This was the first and only place at which the company succeeded continuously in producing a really good effluent, which has even been mistaken by strangers for spring water.

At Leamington the effluent was bad, while the manure was well worth £3 10s. per ton. On the contrary, the effluent at Leeds was excellent, and the manure poor. In the first instance the sewage was rich in animal matter, and in the latter very diluted. But the company entirely failed to gather experience from these facts, and followed the idea that each place should produce precisely the same results, both in regard to effluent and manure. Leeds and Bolton, like Hastings, have fallen out of the hands of the company—in fact, they have no works at present.

During the latter portion of the period we have referred to the funds of the company became exhausted, and a fresh issue of £5 shares was resolved on. Hitherto the nominal £5 shares were unsaleable in the market; but on new patents being taken out, and on rumours of arrangements with Madrid, Paris, Berlin, St. Petersburg, and the United States to purchase the respective patents, the shares rapidly rose in price to a maximum of £45, being then quoted on the Stock Exchange. Not a penny of dividend had been paid, and not a penny of profit had actually been earned, for every ton of guano that has up to this day been sold by the company has had a manufacturing cost at least equal to double its selling price. It was stated at the meeting of last Thursday that the sales of all the manure produced amounted to 4000 tons, bringing in £14,000, since the company commenced operations; but £2000 commission to agents reduces the actual cash receipts to £12,000, while, as we shall presently see, the total of capital expended has been £130,000.

Crossness, the southern outfall of the Metropolitan sewage, was finally adopted as the place where a crucial test of the value of the process should be made. Here works were erected, and the whole operations were placed under the direct supervision of the officials of the Metropolitan Board of Works. We are now writing with the official reports before us, dated respectively January 11, 1873, and January 13 of the same year. According to the report of Mr. Bazalgette (the eminent engineer of the Board), the total cost per ton of Native Guano, produced in the three months trial at Crossness was £6 6s. 4d. per ton, exclusive of rent, interest, depreciation of plant, and other incidental items, and during the whole period of the trial the company's books showed no return in the shape of sales of manure; the amount produced in the period having been 141·72 tons.

Mr. Keates, the chemist to the Board, stated that the condition of the effluent water was, on the whole, extremely good. In fact, his whole report showed that the sanitary result of the A. B. C. process was excellent, for while the effluent could not, of course, be allowed to run into any stream used for drinking purposes, it was entirely free from any chance of sanitary danger. In respect to the value of the manure, Mr. Keates estimated it at 20s. per ton net, taking as the standard the amount of ammonia and phosphoric acid present. This price he considered as its highest value.

Into all the errors and follies of the company we need not enter. We have given quite sufficient facts to show that they have fully missed the course they should have pursued. It is evident, from what has been stated, that there are two classes of sewage, *weak* and *strong*. From the former the A. B. C. can produce a good effluent, and from the latter a good manure. But hitherto the company have pursued an identical course with both, and no reasonable person can expect any other result than that which has befallen them. Had they made large towns, such as Leeds, Bolton, &c., pay them for the use of the process, and chosen small places, with rich sewage for the production of the manure, as their sole payment, their exchequer might have been now flourishing instead of bankrupt.

Having pointed out the engineering and chemical causes which have led to the present state of the company, we may now say a few words in respect to other causes of a purely financial character. The amount expended for procuring new patents in 1870-71 has been something enormous, as *nearly every civilized country throughout the world* has been favoured with patent applications on the part of the company. The travelling, printing, and similar incidental expenses have also been extraordinary. The scientific staff has been ridiculously large, engineers, chemists,

&c., by the dozen having been paid at rates varying from £70 to £2000 a year. In fact, the money of the shareholders has disappeared like dew in the sunshine.

It is no matter of surprise that at the meeting held last Thursday, June 18, at the Cannon Street Hotel, much indignation was expressed by all the shareholders. The past conduct of the company's affairs was universally condemned, so much so that the chairman, Mr. W. C. Sillar, earnestly hoped that, although promised in the general report, a private report should not be read; another reason being that some "delicate" negotiations would be prematurely developed, to the possible disadvantage of the company. After a stormy and highly personal discussion, the report was adopted; but last year's accounts, not having been properly audited, owing to the retirement of Mr. Stansfield, the auditor, were not accepted. Two new directors were elected, as also a fresh auditor. At the subsequent extraordinary meeting, after another scene, which we have rarely seen equalled for disorder and noise, it was resolved to raise £20,000 in £1 shares; but the total to be raised would be £21,461, as, according to an original agreement, Messrs. Sillar are entitled to a *pro ratâ* amount of all new shares issued, which, in this instance, they compromise for £1461 in £1 shares. Eventually it was resolved not to accept Mr. C. Rawson's resignation as general manager.

Having thus given an account of the past and present of the Native Guano Company, we can only express the hope that the errors of the past may become lessons of wisdom for the future. It is impossible that the future course can be worse than the past. But in the face of the fact that there are some scores of places which would be glad to be relieved of their present sewage difficulties, the company have an excellent chance, if prudence and economy direct their councils. The latter will be an essential element of success, as its neglect has been the chief cause of all past failure.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XVIII.

Some matters in connexion with the storeage of coals remain to be considered. The first is the liability of certain kinds to spontaneous combustion. Fires in coal mines are not of unfrequent occurrence, but in these cases the disaster is invariably occasioned by the accidental ignition of the combustible gas stored in the substance of the coal, or collected in crevices. When, however, coal containing a large proportion of pyrites (bisulphide of iron)—*brassy coals*, as they are termed—are brought to the surface and closely packed in a moist condition without free access of atmospheric air, a series of chemical changes commence, which, in the end, produce sufficient heat to cause the ignition of the coal. The chemical changes, so far as the pyrites is concerned, result in its conversion by oxidation into protosulphate of iron, but the action initiated by the pyrites spreads, even when no combustion takes place, and carbonic oxide is produced. This latter change is a source of considerable loss, and the liability to it constitutes an additional reason for precaution when storing pyritic coal. Since, as we have seen, the efficient agents in the production of spontaneous combustion are pyrites, moisture, and a limited access of air, the means of prevention are clearly indicated. In the first place the coal may be sorted, and the most brassy picked out. In the next place coal should only be placed in a close store in a dry state. But in every case it is essential that the stacks should be well ventilated. Various simple and practical means of effecting this object are in use, and may be mentioned.* Mr. Hodgson Jones makes use of baskets without bottoms, which admirably suit their purpose. A thermometer let down occasionally will indicate whether or not a rise of temperature is taking place in the stack. At the Crystal Palace works, brick ventilating shafts are provided. Perforated iron pipes are employed in some works. A very simple means of ascertaining a rise of temperature is made use of by Mr. Woodall at the Phœnix works. Iron rods are inserted in different parts of the stack, and these being drawn up occasionally will give to the hand an indication of any increase of heat in the mass of coal. It need hardly be added that if any decided rise of temperature be observed, the stack should be distributed, and the coal used as quickly as possible; for, apart from the danger of spontaneous combustion and complete loss of the coal, there is the certainty of a very serious deterioration, involving a considerable diminution of the possible production of gas.

Another serious objection to the storing of coal, as far as it can possibly be avoided, is found in the changes which take place in the substance of coal, independent of the oxidation set up by the presence of pyrites. It must be remembered that the chemical alterations which have as their final result the change of woody fibre into anthracite coal, go on continuously, less rapidly under some circumstances than others, but silently and incessantly. The consequence is that in most coals, and especially in those best suited for the production of gas (excepting cannel), a large amount of gas is found occluded in the substance of the coal, the result of changes proceeding within the mass.

The composition of the gas enclosed in coal has been determined by Dr. Lyon Playfair and others in this country; but the most recent and most complete examination has been made by Dr. E. Von Meyer, at the instigation of Professor Kolbe.* The analyses detailed below were made from coal sent to Germany by Messrs. Bell Brothers, of Newcastle, and, therefore, the samples are not to be considered as freshly raised, though doubtless no time was lost before the examination was made. To obtain the gas 100 grammes of the coal was placed in hot de-aërated water, which was then boiled as long as any gas continued to be given off. The gas collected was then analyzed by Bunsen's methods. The following table shows the amount collected and the composition of the gas obtained:—

No. 1. Low main seam, Bewick Colliery, Newcastle.
„ 2. Maudlin seam, Bewick Colliery, Newcastle.
„ 3. Main coal seam, Urpeth Colliery, Newcastle.
„ 4. Five-fourth seam, Urpeth Colliery, Newcastle, 30 fathoms from surface.
„ 5. Five-fourth seam, Wingate Grange Colliery, Durham, 74 fathoms from surface.
„ 6. Low main seam, Wingate Grange Colliery, Durham, 108 fathoms from surface.
„ 7. Harvey seam, Wingate Grange Colliery, Durham, 148 fathoms from surface.
„ 8. Harvey seam, Emily Vil., Woodhouse Close Colliery, 25 fathoms from surface.

Per Centage Composition of the Gas.

No. of Analysis.	District.	Co_2.	CH_4. Marsh Gas.	O.	N.	Cubic Centimètres of Gas from 100 Grammes of Coal.
No. 1 . .	Newcastle	5·55	6·52	2·28	85·65	25·2
„ 2 . .	„	8·54	26·54	2·95	61·97	30·7
„ 3 . .	„	20·86	..	4·83	74·31	27·4
„ 4 . .	„	16·51	Trace.	5·65	77·84	24·4
„ 5 . .	Durham .	0·34	85·8	Trace.	13·86	91·2
„ 6 . .	„	1·15	84·04	0·19	14·62	238·0
„ 7 . .	„	0·23	89·61	0·55	9·61	211·2
„ 8 . .	(?)	5·31	50·01	0·63	44·05	84·0

The above analyses show that the gases enclosed in freshly raised coal consist of carbonic acid, marsh gas, oxygen, and nitrogen, in variable proportions. In addition to these, Dr. L. Playfair is said to have found free hydrogen; but there was probably some mistake in the analysis. The amount of gas found in the Durham coals may cause the reader some astonishment. It corresponds very nearly to 70 and 75 cubic feet in the ton, and calculating the space occupied by a ton of coal, the specific gravity being 1300, at 28 cubic feet, it will be seen that the coal encloses three times its own volume of gas. Dr. Meyer describes the coal as hard and dense, and therefore the condensation of the gas must have been very great. It may be remarked here that the first effect of exposure is the loss of the marsh gas by reason of its highly diffusive power.

The same author has made a series of experiments with German coals, both freshly raised and weathered by exposure, from one to several years, the results of which we may quote briefly as generally applicable. As regards quantity and composition, the gas obtained from freshly raised coal agreed very well with the results obtained with English coal; but on the weathered samples, other gases, higher hydrides of carbon were obtained, which show the serious depreciation coal undergoes when stocked. We quote one series of analyses:—

No. of Analysis.	Co_2.	O.	N.	CH_1.	C_2H_4.
No. 1	16·7	4·9	55·15	3·17	18·61
Collected one week later. . .	11·4	3·8	60·98	3·44	18·88
Collected two weeks later than preceding	12·10	1·10	65·16	3·19	16·85

The formula of the gas in the last column is quoted from the author.

The amount of gas given represents the value absorbed by fuming sulphuric acid in Bunsen's method of analysis, which will be described when we come to speak of the analysis of gas. It is said to be probably a mixture of olefiant gas, butylene, and perhaps propylene, bodies which confer high luminosity on coal gas.

Coals kept for some time in a warm temperature yielded gases of similar composition, but in these the author calculates that more propylene is present. These changes, it will be remarked, involve a continual loss of hydrogen which, as we have stated, is to the gas maker the most important element in coal.

We have said before that coals containing much pyrites undergo rapid oxidation, and that much carbonic oxide is formed. The following is given as the composition of the gas obtained from such coal in the way indicated.

Gases from Weathered Pyritic Coals.

Co. Carbonic Oxide.	O.	N.
48·7	1·8	49·5
38·2	1·2	60·6
54·9	1·2	43·9

It is not so stated by the author; but it may be conjectured that the hydrogen of the coal in these cases is oxidized to water.

Lastly, as regards the actual loss occasioned by exposure to air, we may quote an experiment by Vanentrapp, who ascertained that coal weathered by exposure for some years had diminished in weight to the extent of 38·03 per cent.

* For a further account of these, see JOURNAL OF GAS LIGHTING, &c., vol. xx., p. 549, in a paper read by Mr. A. H. Wood, and discussion thereon, at the meeting of the British Association of Gas Managers for 1871.

* *Journal für prakt. Chemie*, 2nd series, vol. v., p. 407. For abstract in English, see *Journal of Chemical Society* (2) vol. x., p. 798 *et seq.*

We have thus given briefly what may be called a chemical account of the depreciation of coal by stocking. The financial consequences have been so ably and recently discussed in these columns by Mr. Graham, that we need only refer the reader to his paper (*ante*, p. 688) quoting, however, one sentence which cannot be too strongly commended to the attention of gas managers:—

Ten per cent. of loss of illuminating and productive power must be within the experience of most managers who have stocked gas coals, and such a loss on several thousands of tons amounts to so enormous a sum, that it will generally pay much better to purchase fresh coals at considerably higher prices than those originally given for what may have been a lower summer value of the same article; we say *fresh* coal, and not merely coal which has been forwarded from a colliery, but *fresh* coal; for, as prices at present rule in the market, there is only too much reason to fear that they may be productive of another and greater evil—namely, that the colliery proprietor may relieve the gas manager from the necessity of stocking by stocking himself, and those who have once experienced the effects of this species of foresight will not be very desirous of repeating them.

Correspondence.

THE TRANSFER OF GAS UNDERTAKINGS TO MUNICIPAL AND OTHER LOCAL AUTHORITIES.

Sir,—Of late years there has been a growing disposition on the part of local authorities to become possessed of the gas undertakings in their several localities. The Legislature has not discouraged this tendency. Gaslight has now become so much a necessity of existence that it is considered desirable to place its supply in the hands of the local divinities (who can scarcely do any wrong), rather than let it remain in the power of necessitous, interested, and grasping shareholders—descendants of Shylock, all! Had gas supply been a losing speculation, instead of a commercially successful one, its indispensable utility would never have roused the dormant municipal conscience to the duty of providing it for the constituencies. *The dividend has made all the difference.* This is a consideration that should never be lost sight of by the directors and managers of gas companies in their negotiations with local bodies, otherwise the interests of the proprietors, whose representatives they are, may be sacrificed to the *pseudo* patriotic arguments that are so frequently advanced.

These matters are all the more necessary to be borne carefully in mind, when it is remembered that the largest proportion—probably amounting to two-thirds—of the present shareholders in gas companies have purchased the shares which they possess at prices on which the maximum statutory dividend will not exceed 6½, 6, and, in many instances, 5 per cent. per annum. If the interests of such are not fairly weighed, the Three per Cents. would have been a preferable investment, whilst the risks would have been infinitely less. These views are by no means put forward for the first time, as the leading articles in your columns abundantly bear witness, but they need to be reiterated again and again. All transfers of this kind, to be legitimate and fair to those concerned, should be conducted in as purely a business light as would the sale of an established and lucrative business or trade and its appurtenances, in the hands of a private firm.

Shareholders, as well as directors, must be alive to their interests, and an eye should be kept on the movements of such popularity-hunters as are occasionally to be found occupying seats both on the gas board and in the local parliament, with a view to the frustration of such attempts as are sometimes made to sell both the concern and its owners.

No such considerations as the high price of coal and the other requisites of a gas-work should be allowed materially to affect the price of the undertaking. The prices of coal and the other things will either soon return to former rates, or the price of gas must rise. That is a consummation which no opposition can ultimately prevent. If the maximum price of many companies, conducted with due care and diligence, has already been reached, and there is still a deficiency to meet the dividends due to shareholders, then these maximum prices must be extended. A maximum as to price can only be accepted as implying the possibility of its affording a fair and ample return by way of interest on capital. The augmentation of price recently granted to the two largest companies in the country is proof of this; and what is right for the metropolis is also right for the provinces—exceptional legislation cannot be tolerated in this free United Kingdom.

Apparent as these considerations are, there is, nevertheless, an astonishing amount of apathy on the part of many of those principally concerned. This can only arise from ignorance of the subject, or a willingness to trust implicitly in the judgment and rectitude of others. If it be true that, as a rule in gas companies, the rate of dividend, both present and prospective, rules the premium on shares according to the market value of money at the time, then there is danger, as the rage for transfer to local authorities continues to gain ground, if care is not exercised to secure full value, that the premiums on the shares or stock of gas undertakings will rule lower than they have hitherto done. T. N.

THE AUTOMATIC SEWAGE-METER.

Sir,—Permit me to call attention to the fact that Messrs. Denton and Field's "Self-Acting Sewage Regulator; or, Automatic Sewage Filter," as described in your issue of June 9, embodies a principle that I invented and patented, in conjunction with Mr. Josh. Hewitt (dated Nov. 11, 1863) for application to the regulation of the supply of water to water-closets and other purposes, and that many of these closets are now in action.

The immediate object of my invention was to place the service-box in all cases near to the closet, and one of the principal features of the invention was the vertical syphon connected with the bottom of the vessel, which performed precisely the same function as the vertical syphon of Messrs. Denton and Field's tank—viz., that of automatically emptying the vessel when full, but when the inflow had ceased.

It was long my intention to adopt the principle for an automatic flushing-chamber, which would receive water or sewage in a small stream, and discharge it periodically with a flush; but this intention, from various causes, was never actually carried into execution.

I also wish to point out that in Messrs. Denton and Field's tank, when the influx of sewage is small, before the syphon can act it will be preceded by a long and objectionable dribble. This difficulty, together with several others which Messrs. Denton and Field, I have no doubt, will discover, on practical application, is effectually met by my invention.

It is inaccurate to say that the tank is an exact measure of the liquid discharged, as the inflow will continue while the discharge is taking place through the syphon.

T. Mellard Reade, Civil Engineer.
Canning Chambers, 4, South John Street, Liverpool.

PROPOSED ASSOCIATION OF WATER-WORKS MANAGERS.

Sir,—I see in your columns, at various times, accounts of meetings of gas managers and of sanitary engineers, but never any account of meetings of water-works managers. I am not aware whether any society of water-works engineers is in existence, but, knowing how many questions of interest affecting their profession are continually arising—such as provision to meet the scarceness of water, the varied consumptions in different towns, and the varied opinions held on all questions relating to water-works—I think there is a necessity that such a society should be established. As a gentleman remarked at the banquet given to the members of the Gas Managers Association last week, one fool cannot do much, but when two fools meet they may sometimes hit upon a good idea, and still better if there are more fools meet, let alone the benefit that may arise from the meeting of practical men. I am confident that if there was such a society as I speak of it would tend to improve us (water-works managers), and our employers would reap the benefit. I therefore suggest to my brethren the propriety of forming such a society, and I feel confident that, now I have mentioned the matter, it will be taken up by some person better able to carry it out than I am; but I can assure you that I will give my quota to the formation of the society. James Doleman,

Manager of the Sowerby Bridge Water-Works.

June 16, 1874.

SULPHUROUS ACID GAS AS A CURATIVE.

Sir,—As several of the members of the British Association of Gas Managers questioned me on the application of sulphurous acid as a curative, I shall feel obliged if you will allow me to state that the author of the process is Dr. Dewar, M.D., of Kirkcaldy, Fifeshire, who has written a pamphlet, giving his practice both on the human being and on the brute creation.

I would advise every manager of a gas company to procure one of those pamphlets (costing, I think, about 1s.), and, by study of it, try to dispel that London superstition about the injurious effects to man of a little sulphurous acid in the air.

June 18, 1874. George Anderson.

Sir,—In accordance with a request from Mr. George Anderson, I have sent you to-day a copy of some printed facts as to the advantages derivable from the *stated*, and *even continuous*, inhalation of sulphurous acid gas. It is at present in this part of the kingdom in daily use as a deodorant, and otherwise antiseptic agent, and in cases of illness—I may say of every kind—it is had recourse to, *at the outset*, with the most favourable results.

Some of the cures detailed are startling, but every word is true; and, although many have been disappointed as to their sanguine hopes of recovery from ailments otherwise admittedly irremediable, cases every now and then turn up, in apparently desperate circumstances, which encourage us in further testing the merits of the system.

Experience teaches that when the practice is intelligently carried out, the virulence—say, of small-pox, scarlatina, &c.—is shorn of its terrors, and the tenor of the medical periodicals now strides in the direction of what some years ago earned for me the reputation of a lunatic, but that mainly among those in the profession whose lights were not conspicuous. Above all, patients enjoy the "fumes," and thousands now burn sulphur *while undressing* in order to ensure an early sleep.

In the supplement to "Chambers's Encyclopædia," last edition, under sulphur, may be found a critique from a stranger as to its probable value. The process has been gone through in every possible kind of room, and, with the exception of rusting steel, no fault has been laid to its charge.

Kirkcaldy, June 19, 1874. James Dewar.

PROPOSED CORRESPONDENCE COLUMN.

Sir,—I read with pleasure a letter in your Journal of the 16th inst., from a correspondent, suggesting the formation of a column to be henceforth known as the "Correspondence Column," its object being for the better discussion of subjects most interesting to those of your readers who are practically engaged in the manufacture of coal gas, when they could ask and, I hope, receive that information requisite for the proper conduct of works committed to their charge. The foundation of such a column, Mr. Editor, would be a step in the right direction, and would meet with universal approval from every gas maker in this our "sea-girt isle." It may truly be said that there are books upon books on gas, but it is well known to every one in the trade that those books are "relics" of the past, and unsuitable to the present advanced age. Works have increased in magnitude so rapidly within these 10 or 15 years past that "Clegg" and his contemporaries are now only "bad thirds" in the great race of gas manufacture. Therefore I would call upon all of your readers gifted with a scientific turn of mind to impart their ideas to those less favoured until the "History of Gas Lighting" now appearing in the pages of your invaluable Journal is completed and published in a collective form at a price within the reach of all. I trust that R. R.'s suggestion will meet with the support it deserves, and that all inquiries will be replied to in a spirit of brotherly love and affection.

Black Rock, Brighton, June 19, 1874. James Robb.

LEAKY MAINS.

Sir,—In answer to R. R., I would say that, if mains are suspected, they should be cut in sections and tested, as indicated in my articles upon the subject. As it is just possible he may not have seen them, I enclose a reprint, which I shall be happy to send free to any gas manager who is about to repair his mains, or is interested in the matter.

In a few weeks I hope to be able to show the results of a more efficient arrangement, I have just provided for a town now in hand.

Bury St. Edmund's. Thos. H. Methven.

GAS MANAGERS SALARIES.

SIR,—Mr. Livesey, in his excellent address to the British Association of Gas Managers, struck a right chord when he mentioned the duties of many of the profession, and said that the "salaries paid were sometimes far from equivalent for the work done," which is as true a statement as ever was uttered. The situation of a gas manager in a country town is certainly no sinecure, for it often happens that he has the rents to collect, meters to take, &c., besides the cares and responsibilities connected with the carbonizing and distribution. He is looked upon as holding a very respectable position in society, and must necessarily keep himself and family in a respectable manner in order to maintain his *status*. He is also expected to subscribe to all charities and public institutions connected with the place, besides numerous other little *et ceteras*, with, perhaps, a salary of £100 a year, or a little more, and finds it very difficult, even with the utmost economy, to get the two ends to meet. It is undoubtedly a great mistake for gas companies to pinch a good officer, and not allow him a more liberal salary; and it is no wonder he is sometimes discontented, and anxious to get another situation, where, perhaps, his duties may be lighter and his salary more. I consider if directors would pay their managers adequately, when they have a qualified person, it would save the companies money, for the changing of managers is attended with consid rable expense and inconvenience. I know a gas company in England who have had no less than nine changes in the managership during the last 21 years, all through keeping the salary down to the lowest point they could. It is surely better for the welfare of a company to look to the comfort of their manager, thereby giving him heart and encouragement to go into his work thoroughly, acting on the good old maxim, that "the labourer is worthy of his hire."

CLAUDE.

THE GAS CONSUMERS PROTECTION SOCIETY. DEPUTATION TO THE BOARD OF TRADE.

SIR,—Referring to your remarks of last week upon my statements to the President of the Board of Trade, permit me to say that the loss of illuminating power in gas, whilst travelling in the main, is probably caused by the condensation of the hydrocarbons, which, in popular language, are the light-giving properties of gas. Mr. Hawksley, and other eminent gas engineers, have stated before parliamentary committees that this loss is a fact, and to the extent I mentioned to Sir C. Adderley. I have also proved it by experiment. In speaking of gas referees, I should have said gas commissioners, the latter being the gentlemen to whom I referred. I alluded to the Railway Commission more as an *example* of control sanctioned by Parliament than a precedent to be copied in *detail*. I still believe that such a control exercised by *one* body of competent commissioners over the gas companies would prove a fair and practical settlement of the legitimate grievances of gas consumers, satisfactory to both parties, and likely to be adopted. NORWOOD EARLE.

Mansion House Chambers, 12, Queen Victoria Street, London, June 16, 1874.

LIGHTING OF PONCE, PORTO RICO.—This town was lighted with gas on the 18th of last month. The works have been carried out by Mr. Steinacher in a most able manner, for and on account of Mr. George Bower, St. Neots, Hunts, who supplied the whole of the necessary plant. The utmost enthusiasm was evinced by the inhabitants on the occasion of the first lighting of the public lamps.

SANITARY AND EDUCATIONAL EXHIBITION.—It is announced that the third exhibition of sanitary, educational, and domestic appliances in connexion with the Social Science Congress will take place from the 30th of September to the 10th of October next in the Drill Hall, Burnbank, Glasgow. The object of the exhibition is to bring under the notice of the public generally, and particularly those who are interested in social, sanitary, and educational questions, the latest scientific appliances for improving the public health and promoting education. The first four classes of exhibits will be the following:—1. Warming, ventilating, and lighting, which will comprise grates, stoves, flues, furnaces, boilers, hot air and water processes of warming, systems of ventilation, lamps, gaseliers, jets, reflectors, &c. 2. Cooking and domestic appliances and economic apparatus, to consist of stoves, ranges, and ovens (heated with gas or otherwise), for roasting, baking, or boiling, &c., food manufacturing machines, culinary utensils, and articles of domestic utility and household economy. 3. Sanitary architecture and appliances, for outward and interior ornamentation, including lavatories, baths, closets, filters, fountains, ornamental bricks, tiles, cements, concretes, slag, stoneware, and clayware. 4. Sanitary engineering and disinfectants for all things connected with the supply of water, drain-pipes, tubes, sinks, taps, traps, troughs, closets, urinals, filters, sewage and drainage contrivances, disinfectants, deodorants, antiseptics, &c.

MAKING IRON WITH NATURAL GAS.—A correspondent of the Pittsburgh *Commercial* says: "Allow me, as a manufacturer deeply interested in the growth and improvement of this iron city, to give yourself and readers a slight sketch of one of the most interesting innovations in the mode of making iron ever introduced. Hearing that a well-known firm of iron manufacturers, whose works are situate at Leechburg, on the West Penn Railroad, some 30 or 40 miles hence, had applied natural gas as a substitute for coal as fuel, I took a run up to see the *modus operandi*. I found that the gas was procured from a well originally sunk for oil, but the parties who had started it with that object had given it up with disgust, and it was simply a happy thought which suggested to the very practical Mr. Rogers the feasibility of utilizing the gas which was so wastefully roaring away, and by the aid of a few pipes he has had the gas conducted across a bridge into the rolling-mill, and where it does duty from firing the boilers, puddling, heating, annealing, to lighting up the works, and with the happy result of a quicker and better yield and quality incomparably superior to iron worked with coal as fuel. I have no hesitation in saying this simple arrangement will completely revolutionize the manufacture of iron in future. The wonderful benefits to quality and yield, and the pecuniary advantages, are so great and apparent that no one can compete, except at a loss, with "coal *versus* gas." A few years hence and all that district will be studded with mills, forges, and furnaces. Already an arrangement has been made to sink other wells (one is being sunk now) and to locate works. The landowners, with creditable policy, have agreed to a certain royalty to the enterprising gentleman who had opened up this mine of wealth; and now it remains to be seen whether Pennsylvania (with the extraordinary advantages nature has given Tennessee and other States) will lie quiescent and allow the sceptre of King Iron to slip from her grasp. This opportune discovery, which yields 33 per cent. extra quantity with the same machinery, and 10 dols. to 20 dols. per ton better price, gives to us a decided victory if followed up. The situation, too, is all that could be desired. Communication east, west, north, and south is secured by the Pennsylvania Railroad running through the district, timber and coal are abundant, and it seems a natural centre for the manufacture of iron. The saving alone at this work at Leechburg is upwards of 700 dols. per week, and it will be well for our manufacturers to look into this matter. Many have done so, and all, I believe, are impressed with the extraordinary advantages offered."

Parliamentary Intelligence.

HOUSE OF LORDS.

MONDAY, JUNE 15, 1874.

BROADSTAIRS WATER (No. 1) BILL.—Report from the Select Committee read, that it is not expedient to proceed farther with the Bill.

The Hythe Improvement and Water Bill (the Queen's consent having been signified) was reported, with amendments.

The Chester Water Bill was reported, with amendments.

The Edinburgh and District Water Bill was read a second time, and committed.

The Lymm Water Bill was returned from the Commons with the amendments agreed to.

The Gas and Water Orders Confirmation Bill was read the third time, passed, and sent to the Commons.

A petition against alteration in the Belfast Water Bill was presented from the Carrickfergus Municipal Commissioners.

TUESDAY, JUNE 16.

The Fylde Water Bill was reported, without amendment.

The Dublin Corporation Water, Skipton Local Board of Health, and Belfast Water Bills were read a second time, and committed.

The Padiham Water Bill, brought from the Commons, was read a first time, and referred to the Examiners.

The Hartlepool Gas and Water and Leeds Corporation Water, &c., Bills were returned from the Commons agreed to, with amendments; the said amendments were considered and agreed to.

The Peterborough Gas Bill was returned from the Commons with the amendments agreed to.

The Lord Chancellor acquainted the House that the Standing Orders applicable to the Wigan Improvement Bill have been complied with, but that in the case of the Padiham Water Bill they have not been complied with. The Examiners certificate (in the latter case) was referred to the Standing Orders Committee, who afterwards reported, "That the Standing Orders not complied with in respect of the Padiham Water Bill ought to be dispensed with, and the Bill allowed to proceed." This was agreed to.

A petition against alteration in the Belfast Water Bill was presented from Lord Arthur William Hill.

THURSDAY, JUNE 18.

The Cupar Water, Dundee Water, Wigan Improvement, and Padiham Water Bills were read a second time, and committed.

The Aberdare and Aberaman Gas, Hythe Improvement and Water, and Chester Water Bills were read the third time, with the amendments, passed and sent to the Commons.

SATURDAY, JUNE 20.

The Enniskillen Gas Bill was returned from the Commons agreed to, with an amendment, which was considered and agreed to.

The Horbury Local Board Bill was referred to a Select Committee, consisting of Lord Hanmer (chairman), Marquis of Queensberry, Marquis of Exeter, Lord Leconfield, and Lord Brougham and Vaux, to meet on Monday, June 22.

The Wakefield Water and Edinburgh and District Water Bills were referred to a Select Committee, consisting of Lord Aberdare (chairman), Lord Vernon, Lord Foley, Lord Carysfort, and Lord Ellenborough; to meet on Tuesday June 23.

HOUSE OF COMMONS.

MONDAY, JUNE 15, 1874.

The Lords amendments to the Peterborough Gas Bill were agreed to.

The Hartlepool Gas and Water Bill (Lords) was read the third time; verbal amendments made; Bill passed, with amendments.

The Leeds Corporation Water, &c., Bill (Lords) was read the third time, and passed, with amendments.

The Enniskillen Gas Bill (Lords), as amended, was considered; to be read the third time.

The Padiham Water Bill, as amended, was considered, and it was ordered, that Standing Order 242 be suspended, and that the Bill be read the third time on Tuesday, June 16.

Report read, that the Standing Orders not previously inquired into, and which are applicable thereto, have been complied with in the case of the Nottingham Corporation Gas Bill (Lords).

The Sanitary Laws Amendment Bill was read a second time, and committed for Monday, June 22.

TUESDAY, JUNE 16.

The Padiham Water Bill was read the third time, and passed.

The Fairfield Local Board and Wrexham Water Bills (Lords), as amended, were considered; to be read the third time.

METROPOLIS WATER SUPPLY, &C., BILL.—The following resolution was reported from the Standing Orders Committee—"That, in the case of the Metropolis Water Supply and Fire Prevention Bill, the Standing Orders ought not to be dispensed with."

WEDNESDAY, JUNE 17.

The Middlesborough Extension and Improvement Bill (Lords), as amended, was considered; to be read the third time.

The Alliance and Dublin Gas Bill (Lords) was read a second time, and committed.

THURSDAY, JUNE 18.

The Enniskillen Gas Bill (Lords) was read the third time, and passed, with an amendment.

The Llanelly Gas Bill (Lords) was reported, without amendment.

The Westleigh, Pennington, and Bedford Local Boards Bill (Lords) was reported, with amendments.

The Gas and Water Orders Confirmation Bill (Lords) was read a first time.

FRIDAY, JUNE 19.

The Fairfield Local Board Bill (Lords) was read the third time, and passed, with amendments.

A petition against alteration in the Alliance and Dublin Consumers Gas Bill (Lords) was presented from consumers of gas in the city of Dublin and its vicinity.

GAS PRESSURE ALARM.—When two neighbouring buildings are illuminated by gas derived from the same source, it frequently happens that the extinction of the lights in one building causes the pressure of gas in the other to become greatly increased, and sometimes to result in accident. M. Launay proposes, as an alarm to give warning of this over pressure, a bisulphate of mercury battery, in which the liquid is in communication with the gas by means of a siphon, so that the pressure of the gas in varying, raises or lowers its level. If the pressure is above a certain fixed limit, the liquid is raised so as to come in contact with the metallic portion of the battery, establishing a current which sounds an electric alarm. M. Launay also suggests that a simple method of determining leaks in gas-pipes throughout a building is to force some strongly odorous smoke into the supply-pipe. The fumes of incense, for example, escaping in any room, would be readily distinguished from gas, and the locality of the leak quickly found.

Legal Intelligence.

COURT OF CHANCERY.—Friday, June 20.

(*Before Vice-Chancellor* Bacon.)

WARWICK AND BIRMINGHAM CANAL COMPANY *v.* BALSAL HEATH LOCAL BOARD OF HEALTH.

Mr. Kay, Q.C., and Mr. Speed appeared for the plaintiffs; Mr. Chitty, Q.C., for the defendants.

In this case a bill had been filed against the clerk of the Local Board of Health for Balsal Heath, their statutory public officer, for the purpose of suing and being sued, to restrain their discharging sewage matter into a feeder of the Warwick and Birmingham Canal so as to foul the water of the canal. At the hearing of the cause an injunction was granted, and subsequently the court made an order that a writ of sequestration of the property of the board should be issued, but suspended the issue for a time to allow the board to take steps to abate the nuisance.

Mr. Chitty now applied for a further extension of time for the completion of the works, in order to comply with the injunction. The board were doing the utmost in their power to comply with the order of the court. There was an injunction and a sequestration order out against them. They were building fresh filtering-beds at Sparkbrook, and intended treating the sewage with lime, which would effectually destroy all noxious results. Three months, they had evidence to show, would be ample for completing the works, and no part of the sewage would then pass into the canal in an unfiltered state. The cost of the new tanks would be about £290.

Mr. Kay, who appeared for the plaintiffs, contended that the works were altogether insufficient for the purpose of effecting what the court had directed. The defendants had been exceedingly neglectful, or they could have executed the necessary works long ago.

The Vice-Chancellor said this was one of the worst of the numerous cases of the kind that had been before the court. The conduct of the defendants had been obstinate and perverse, if not contumacious; but as they were a public body, with difficult duties to perform, he did not see what benefits would accrue to the plaintiffs by allowing the writ of sequestration to issue at once. Upon the representation, therefore, of the defendants, without vouching for the accuracy of that representation, he would make an order to suspend the issue of the writ for three months.

GREENWICH POLICE COURT.—Saturday, June 20.

(*Before Mr.* Balguy.)

CONNOR *v.* SURREY CONSUMERS GAS COMPANY.

The plaintiff, a stoker, sued the company for refusing to pay him the sum of 37*s.* 4*d.*, being a week's wages in lieu of a week's notice.

Mr. Bannister appeared for the gas company.

The complainant stated that he was engaged with two others in a gang. On Sunday morning, the 31st of May, they had to go to the works to be ready to assist in drawing the retorts. He overslept himself, as also did the other two men. On the following morning they went to work, and were then told by Mr. Miller, the foreman of the stokers, that he should give them "a drill for a few days," *i.e.*, suspend them from work. On Tuesday morning he and the other two men went to the works, when Mr. Miller told them he would let them know on Friday what he intended to do. On that day Mr. Miller put the other two men on again, but discharged the complainant with only the pay due for the one day's work done that week.

In cross-examination complainant admitted that on the 10th of May he stayed away from work without leave, and that on another occasion he had refused to work with a fresh man set on to help him.

Mr. *George Miller*, foreman of stokers at the Surrey Consumers Gas-Works, was called for the defence. He said he told the three men that he would tell them in a few days what he would do, and that he had dismissed the complainant on account of the complaints made against him.

The Magistrate held that what the defendant said to the men on the Monday was a waiving of the act of dismissal, and only amounted to suspension as punishment. The dismissal of the complainant ought not to have been deferred, as it prevented him during those four days seeking other employment. He should, therefore, order four days money (£1 1*s.* 4*d.*) and 2*s.*, costs of summons, to be paid, deducting the other three days of the week's wages as some compensation to the company for the loss they had sustained in having to get the services of three other men.

Mr. Bannister said the result of this proceeding would be that for any infraction of contract on the part of the workmen they would have to be instantly dismissed, and no suspensions could be made to allow of an inquiry into extenuating circumstances.

THE RAILWAY COMMISSION.

Thursday, June 11.

(*Before Sir* F. Peel, *Mr.* Macnamara, *and Mr.* Price.)

THE CHAMBERS COLLIERY COMPANY *v.* THE LANCASHIRE AND YORKSHIRE RAILWAY COMPANY.

MANCHESTER CORPORATION GAS-WORKS.

Mr. R. G. Williams, Q.C., appeared for the applicants, and Mr. Field, Q.C., and Mr. Edwards appeared for the railway company.

Mr. Williams said this was an application on behalf of Messrs. Lees, of Higher and Lower Clarksfield, near Oldham, against the railway company, to prevent them from giving undue preference to the Corporation of Manchester, as against the applicants. There would, he thought, be no dispute as to the facts; the points in dispute were substantially legal ones. The applicants were proprietors of some collieries in the neighbourhood of Oldham, and had carried them on for many years; in fact, long before the railway was made. From 1847 these collieries had been connected with the railway, and the coal had been carried on the line from Oldham to Manchester, where the applicants carried on the business of coal dealers. In order to facilitate their business they purchased a piece of land adjoining the Oldham Road Station, and had constructed a siding there. It was a matter of the utmost importance to the applicants that they should have a wharf immediately adjoining the station, and this state of things continued down to November, 1872. The Manchester Corporation required large quantities of coal for the use of their gas-works. In August, 1872, the railway company, finding the station was too contracted, determined to bring all the goods traffic to the Oldham Road Station, and to remove all the mineral traffic to Miles Platting, and notice was given to the applicants that after the 30th of October no minerals would be conveyed to the Oldham Road Station, and since that date they had refused to carry the applicants coal there. The applicants, however, complained that the company had made an exception in favour of the Manchester Corporation, and still carried coals for the corporation to the station. This, they held, was undue preference, and came under the second section of the Railway Act. Applicants simply desired to have their coal carried to the station and delivered in the same way as the corporation coal was delivered. He apprehended that the answer of defendants would be that the applicants were coal dealers, whereas the corporation simply required the coal for the gas-works. He contended that it was immaterial what was to be done with the coals if he established that undue preference was given to the corporation.

Mr. Macnamara: You contend that the applicants ought to be treated on equal terms with the corporation, even if it involves excluding the corporation from Oldham Road Station? You would, however, prefer being accommodated there too.

Mr. Williams said that was his case. He pointed out, in conclusion, that another coal dealer, Mr. Richmond, had been bought up, and that applicants only were aggrieved.

Mr. Field, Q.C., on behalf of the defendants, said the gas-works were in existence long before the company went to Oldham Road.

Mr. Williams said counsel ought not to make that statement.

Sir Joseph Heron (town-clerk of Manchester): It is perfectly correct. They were there many years before.

Mr. Field said the company at first conducted its traffic in both minerals and goods at Oldham Road, but owing to the great increase of traffic consequent on the vast increase in the population of Manchester, the company decided to conduct the goods traffic only at Oldham Road, and the mineral traffic at Miles Platting. In 1864 the goods traffic was 265,863 tons, and in 1872, 471,504 tons; and the coal traffic, which in 1864 was 64,737 tons, increased in 1872 to 141,125 tons, and, of this, 108,900 tons belonged to the Corporation of Manchester, leaving less than 4000 tons carried for general dealers.

The Chairman: If you can conduct so large a traffic for the corporation, surely you might do the small business for the applicants.

Mr. Field said this would render it necessary to provide accommodation for all the small dealers. The corporation was not a vendor or dealer, and as its position was not akin to that of dealers, the company had not shown the corporation undue preference in continuing to carry the coals for the gas-works to Oldham Road. The applicants sent to Oldham Road 3695 tons in the year—about 10 tons a day—and the commissioners must consider whether one particular consumer of 10 tons a day could call upon the company to make an exception in his favour to the inconvenience of the general traffic at Oldham Road. If this were allowed they would have to do the same by all the other small dealers.

Mr. Macnamara said they would have to show they were similarly situated as the applicants in this case.

Mr. Field said the applicants must make out there was undue and unreasonable preference.

Mr. Macnamara: Can you show us that you cannot carry this coal without obstructing your general traffic?

Mr. Field: Yes.

Mr. Macnamara: Because it may be desirable that you should do so.

Mr. Williams said he was not placed yet in a position to contest this point, and he therefore submitted his learned friend ought to amend his answer.

Mr. Price thought the point had been sufficiently raised. In the answer there was no doubt as to the preference.

Mr. *Thorley*, traffic manager, was then briefly examined by Mr. Edwards, and explained from plans the points mentioned in the opening statement of Mr. Williams. He stated that all the room in the yard at Oldham Road was necessary to the proper working of the goods traffic. Due notice had been given to the dealers of the changes which had been made affecting them. When the changes were made it was fully resolved to carry the corporation traffic as usual. There was no concealment about it.

In cross-examination, the *witness* said the corporation sold a good deal of coke. All that the corporation sold was carried by the railway. As between the parties, it never entered into his consideration that the company was carrying 100,000 tons for the corporation.

By the Commissioners: It was owing to a report I made that the change was made. The fact was complaints were made that we were getting into disgrace, as compared with other companies, in the delivery of goods, and I reported that the station must be given up to goods traffic. We had no practical control over the dealers coal traffic, and I thought the best course was to send away all the traders from Oldham Road. In consequence of that Miles Platting was prepared for the reception of the traffic. I considered I was justified in drawing the line between traders and non-traders. The quantity carried for the corporation is increasing. A higher price is not paid for the carriage of the corporation coal or for the accommodation, but the terminal charges at Oldham Road, I think, are higher than at Miles Platting. No other dealers besides Messrs. Lees have land at Oldham Road.

Mr. Field then handed in the report to which Mr. Thorley referred, and upon which the change to Miles Platting was made.

In reply to Mr. Price, the *witness* further stated that railway companies now more than ever were driven to the separation of their coal and goods traffic.

Mr. *John Jackson*, the goods superintendent at Oldham Road Station, was the next witness, and he explained the alterations in the traffic made in 1872, its working now, and the effect the introduction of applicants traffic would have on the general traffic. If their traffic was introduced, the company could not work it satisfactorily to themselves and the consignees. There was not sufficient room.

Friday, June 12.

Mr. *Jackson*, the goods superintendent, in cross-examination, said the coal of the applicants might be accommodated as the corporation coal was accommodated, but this would cause great inconvenience. The corporation supply was regulated from the pits. He never made any complaint direct to the colliery company of the inconvenience of their traffic. There was a good deal of outward traffic of the corporation coke.

Sir *Joseph Heron*, town-clerk of Manchester, was examined this morning. He stated that, although Miles Platting Station was not within the city of Manchester, yet it was immediately adjoining, and was surrounded by a large population, who were especially large consumers of the mineral. The corporation had, he said, acquired the power to light the city and the surrounding districts; and there was, in fact, no limit as to distance, for the corporation supplied the gas for miles around. The works (which were in Rochdale Road) existed long before the railway company had formed the line, and they had been from time to time extended; but they would not have been if it had not been for the contiguity of the railway to the works. The retorts of the corporation could hold 4,500,000 cubic feet of gas, and that quantity was manufactured daily during the last winter months. Not only was this the case, but the demand was constantly increasing, and provision was made for the storeage of 6 million cubic feet, to cover the possible exigencies of the town. The works covered 8½ acres of land, and were supplied with sidings for the storeage of coal and for bringing it into the yard. The delivery of coal averaged from 1500 to 2500 tons per week. In 1864 the coal and cannel used amounted to 48,079 tons, and the gas produced was 491,836,000 cubic feet; while last year the coal and cannel used amounted to 91,117 tons, and the gas produced was taken to be 911,337,000 cubic feet. The corporation would never have extended these works in the locality of the Oldham Road Station if it had not been for the accommodation afforded through the contiguity of the station, and if the corporation were deprived of the facilities which they now derived from this contiguity it would be virtually the stoppage of the works, for it would not only be inconvenient to cart the necessary minerals from the Miles Platting Station, but the cost would be so much that the corporation might be compelled to give up the works at Rochdale Road.

In reply to Mr. Macnamara, *witness* said that if the Messrs. Lees had the use of Oldham Road Station, as they asked, the company could not deny the same privilege to all other dealers. As to the use of the station by the corporation, this body were convinced that it was to the interests of the railway company to continue the carrying of coal to that station for the corporation.

Mr. Macnamara said the commissioners did not desire to deprive the corporation of any advantage they might possess in thus having their coals carried

to their works; but it was desired to see if the public, through the dealers, could not be placed on a footing of equality with regard to the obtaining of coal.

Mr. *H. L. Illingworth*, the manager of the Chambers Colliery Company, was next examined. He said he had had the management of the Chambers collieries for many years—upwards of 20—and he could say that the traffic of his firm in regard to the conveyance of coals in Oldham Road was such as never to obstruct the line. In point of fact, the carrying was entirely in the hands of the railway company, and was carried on by the company entirely at their own time, discretion, and convenience. The coals were stacked and stored in the yard adjoining the Oldham Road Station, when they were carried there, and the great advantage to the Messrs. Lees from this was that they were enabled to serve their customers from the stacked coal in winter time. Besides, the railway company used to charge 11d. a ton for carrying to Oldham Road; but had increased the carrying price to 1s. for Miles Platting, and the cost of cartage from one station to the other was 1s. 8d. a ton. Thus the Oldham Road Station was nearly a mile nearer the centre of Manchester than was the Miles Platting Station, and was more convenient in many respects for the Messrs. Lees business.

Mr. FIELD addressed the commissioners on behalf of the railway company, and contended that as the arrangements the company had made were for the public convenience, it would be a dangerous precedent to disturb them, as every company would be at the mercy of dealers. He drew a distinction between the Corporation of Manchester and dealers, and urged that in giving the former facilities for conducting their gas-works, which manufactured the gas for the immense district of Manchester, the company was really doing the very best which could be done for the public advantage. The commissioners were asked by the applicants to say that the railway company should keep up sidings and keep them clear for whoever asked for them, whether they paid or whether they did not, for, if this application was granted to the Messrs. Lees, the like advantage could not be denied to other dealers, whatever might be their business. All that they would have to do would be to purchase a piece of land near a station and then demand the right to be served there, and to grant this would be to say that the railway company had no right to make any re-arrangements which the increasing population, and consequent increasing traffic, might render necessary. In point of fact, this would be placing the railway companies in the hands of dealers. He then entered on the merits of the case, urging that it was more convenient for the railway company to take the traffic of the corporation at the Oldham Road Station, as that was regular, and therefore could be provided for, while the traffic of the dealers was irregular, and therefore entailed difficulties in dealing with it at a station at which the general traffic was increasing so largely. Moreover, the corporation's siding paid for itself, but the others did not; and to have the "same facilities" which the corporation had, each dealer would have to have a siding to himself, even if only drawing two trucks a day, and the difficulties of such a position were obvious. Then he urged that by the manner in which the coal traffic had been conducted between the railway company and the Corporation of Manchester, the latter had a right to look to be served at this station on their own works, just as if there were a signed and sealed contract.

Mr. WILLIAMS, in reply, urged that it was impossible for the commission to separate the corporation in their capacity of gas manufacturers, and therefore traders, from other coal purchasers, and the fact that the corporation were immense consumers of the mineral gave them no special claims over others. They were only coal consumers, and, as such, should have no facilities which were denied to others.

Sir F. PEEL said the commissioners would consider the case, and give their decision at a future meeting.

TUESDAY, JUNE 16.

Sir FREDERICK PEEL delivered the judgment of the commissioners this day. He said: The complainants in this case are Messrs. John and Joseph Lees. They obtained a summons calling upon the Lancashire and Yorkshire Railway Company to show cause why a writ of injunction should not issue against them, and their object was to compel the company to desist from excluding them in an accommodation in the carriage and delivery of coal, of which at present the Corporation of Manchester have the exclusive enjoyment. The railway company have separate stations in Manchester for goods and for coals and minerals. Till lately the Oldham Road Station was their station for goods of all kinds; but as it was of no great extent, and the quantity of goods was increasing beyond its capacity, the company decided, in 1872, to withdraw from it their coal and mineral traffic, and to establish a coal and mineral depôt at Miles Platting, about a mile distant. They gave notice to the different coaldealers at the Oldham Road Station that coal would cease to be delivered to them there, and would be dealt with at Miles Platting instead; but the complainants, who own and work collieries at Oldham, under the name of the Chamber Colliery Company, and do a coal business at Manchester, insisted that their coal should continue to be delivered to them at the Oldham Road Station, on the ground of their possessing a small coal-yard adjacent to the company's yard, and connected with it by a siding, so that they had not, like other dealers, to unload on the company's premises, but were able, immediately after their loaded trucks were delivered to them by the company, to take them on into their own yard, and there unload them. The railway company, however, declined to make any exceptions, or to treat Messrs. Lees, the complainants, differently from other coal dealers, and from November, 1872, they have refused to deliver coals for them for their Manchester coal business at any other place than Miles Platting. The Rochdale Road Gas-Works of the Corporation of Manchester, who exercise lighting powers over the city and its suburbs, are, as it happens, close to the Oldham Road Station, and, like Messrs. Lees yard, are connected with the station by a siding, along which all the coal is conveyed. The quantity of coal so consigned is of course very large, and two-thirds of the coal, or about 100,000 tons out of a total of 140,000, received at the Oldham Road Station in 1872, were for the above-mentioned gas-works. This part of the Manchester coal traffic the railway company did not remove to Miles Platting. They continued to carry it on as before at their Oldham Road Station, and the number of tons of coal consigned to the corporation for delivery at the gas-works, and carried to the Oldham Road Station by the company, is a continually increasing quantity. Messrs. Lees complain of this unequal or different treatment of the corporation and of themselves and other coal proprietors and dealers; and for themselves they say that they are in like circumstances with the corporation in respect of having room for coal-trucks on their own ground; and that for the railway company to carry coals to that station exclusively for the corporation is to give an undue preference to the corporation, contrary to the provisions of the Railway Traffic Act, 1854. The enactment thus referred to is the second section of the 17th & 18th Vict., cap. 31. It requires every railway company to afford all reasonable facilities for the receiving, forwarding, and delivery of traffic, and forbids any company from making or giving any undue or unreasonable preference or advantage to or in favour of any particular person or company in any respect whatever, or from subjecting any particular person or company to any undue or unreasonable prejudice or disadvantage in any respect whatever. It is not contended that the Lancashire and Yorkshire Railway Company fail to afford reasonable facilities for coal traffic by placing their depôt for coals at Miles Platting; nor does it appear that they designed to subject any particular person to any disadvantage, because, with one exception, the consignees of coal were all alike, in a general sense, affected by the removal from Oldham Road, and the measure applied indifferently to them all. That exception was the Corporation of Manchester, and to that body, undoubtedly, the company had given a preference by carrying coals to Oldham Road Station for them and for no one else; and preference, in any respect whatever, and whether consisting of a difference of charge or of accommodation or of treatment generally, is unlawful, unless it can be shown that it is not undue or unreasonable. Of the preference in question before us, we observe, in the first place, that it has not about it certain points or incidents that would at once condemn it. Messrs. Lees, the complainants, were sufferers by the company ceasing to deliver their coal at Oldham Road, where they had incurred expense in acquiring a piece of ground the better to conduct their business. But the preference given to the corporation was not *per se* a detriment to them. There was no competition of interest to make it so. The corporation did not sell coal. Had it been otherwise, had Messrs. Lees and the corporation been in the position of trading companies with one another, each would have been entitled to be treated as the other, and it would have been for the public benefit that no difference should be made between them, and that the railway company should not be allowed to refuse to carry for one while carrying for the other. Again, Messrs. Lees are coalowners, and the purpose or effect of the arrangement with the corporation might have been to favour particular coalowners or dealers supplying the municipality at the expense or to the exclusion of the Messrs. Lees. No such allegation has been made, and it appears in evidence that the corporation buy in open market, and that, provided the coal is consigned to the corporation, the company convey it to the Oldham Road Station by whomsoever it may be forwarded. But do reasons exist for holding that, in giving to the corporation, to the exclusion of other persons, access to a particular station to obtain a supply of coal, the railway company, on the whole, have made no unfair use of their powers and of their monopoly of the carrying trade? That the company should be willing within their powers to oblige the corporation is likely enough, and one witness for the company laid stress upon this as a cause of the preference; but we desire to test the character of the preference by its tendency in respect of public benefit and convenience. We have no doubt as to how the public are best accommodated in this case. The difference of convenience and expense in carrying coal by the ordinary road and by railway must always be great; but it would be distinctly disadvantageous to the public that the large quantities of coal daily taken to the municipal gas-works should have to be carted through the crowded streets of Manchester from a station so distant as Miles Platting. As a mere centre of distribution to coal consumers in general, Miles Platting may be as convenient to the coal trade as Oldham Road; but for coal to be consumed at the gas-works adjoining to the Oldham Road Station, that station is a necessary appendage to them, and as convenient as Miles Platting would be the reverse. It may, in addition, be mentioned that the nature and magnitude of the coal traffic to the gas-works permit of the railway company making such special arrangements for passing it through and out of their station that it is conducted with less inconvenience to the general and ordinary business of the station than would be caused by a much smaller quantity, with which goods of all kinds might be intermixed. Considerations such as these appear to have led the company to keep this part of their coal traffic at Oldham Road, when they removed the remaining part of it to Miles Platting. And we do not think that in carrying coal for the corporation to a station to which they will not carry coal for other persons, the company are, under the circumstances, abusing their powers as carriers on the line, nor do we think that the one point which distinguishes Messrs. Lees from the other coal dealers, and which assimilates their position to that of the corporation, the possession, namely, of a piece of ground in direct communication by a siding with the company's ground, so far removes their case from that of the other coaldealers, or puts them in such like circumstances with the corporation as to cause the preference given to the corporation to become an undue and unreasonable preference as against the complainants, the Messrs. Lees, when we cannot hold it to be such as against the public at large. We shall not make any order as to costs.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the composition and quality of the metropolitan waters in May, 1874:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen.		Hardness.	
			As Nitrates, &c.	As Ammonia.	Before Boiling.	After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	17·11	0·051	0·097	0·002	14·3	3·3
West Middlesex	16·97	0·049	0·131	0·000	14·0	3·3
Southwark and Vauxhall	17·07	0·053	0·115	0·002	14·1	3·4
Chelsea	17·17	0·042	0·117	0·002	14·4	3·4
Lambeth	16·89	0·054	0·132	0·001	14·0	3·4
Other Companies.						
Kent	27·13	0·004	0·244	0·000	20·8	5·6
New River	16·33	0·027	0·132	0·000	13·8	3·3
East London	17·23	0·048	0·137	0·002	14·4	3·3

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours; and in the case of the metropolitan waters the quantity of organic matter is about eight times the amount of oxygen required by it.

The water was found to be clear and nearly colourless in all cases but the following, when it was more or less turbid—namely, in those of the Grand Junction, the Lambeth, the Southwark and Vauxhall, and Chelsea Companies. The average quantity of water supplied daily to the metropolis during the preceding month was, according to the returns of the water companies to the Association of Medical Officers of Health, 111,701,473 gallons; and the number of houses supplied was 509,569. This is at the rate of 33·3 gallons per head of the population daily. The last official return from Paris stated that the average daily supply per head of the population was 28·5 gallons; but this includes the water used for the public fountains, and for the ornamental waters in the Bois de Vincennes and the Bois de Boulogne.

HY. LETHEBY, M.B.

Major Bolton's report for the month of May states that the condition of the river at Hampton, Molesey, and Sunbury, where the intakes of the West Middlesex, Grand Junction, Southwark and Vauxhall, Lambeth, and East London Companies are situated, was very good from the 1st to the 30th, and indifferent on the 31st. The highest flood state of the river at Hampton during the month was 5 inches above the (6 feet) summer level, and the lowest 1 inch below. At Ditton the state of the water in the river during the month was good for 26 days, and indifferent for 5 days. The Chelsea Company is now the only one whose intake is below Hampton Court bridge. The highest state of the flood water at this place was 5 inches, and the lowest 1 inch above summer level. The highest temperature of the water during the month was 63°, and the lowest 53°, while the highest temperature of the air at the same place was 73°, and the lowest 47°. These observations were made daily at 9 a.m. The rainfall during the month was under half an inch. The water at the Thames intakes was very good during the month. The West Middlesex Company is the only Thames company at present, which, having large reservoir capacity, avoids taking in water during floods. The Lambeth Company are making large subsiding reservoirs at Molesey, and the construction of additional subsiding and impounding reservoirs by the Chelsea, Grand Junction, and Southwark and Vauxhall Companies is most desirable, so that when the river is in a turbid condition, the flood water may be allowed to pass.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) ACT.

Deputation to the Home Secretary.

A Deputation from the Committee of the Gas and Water Companies Association waited by appointment upon Mr. Secretary Cross, at the Home Office, on Tuesday last, to lay before the right hon. gentleman their views in reference to the amendment of the above Act.

Mr. Michael, in introducing the deputation, said: Sir, the gentlemen present constitute a deputation from the committee of the Gas and Water Companies Association, which sits in London, and represents between 200 and 300 gas and water companies in various parts of the kingdom. We are desirous of laying before you our views with respect to some proposed alterations and amendments in the Municipal Corporations (Borough Funds) Act. You are aware, sir, that before 1872 very considerable uncertainty existed as to the state of the law in regard to the payment by corporations and local authorities of expenses incurred by them in promoting or opposing bills in Parliament. There was up to that time no guarantee that however much in the public interests the local authorities might exert themselves to promote or oppose a bill in Parliament, if the promotion or opposition failed, they would be able to recoup themselves for the expenses incurred, and it frequently happened that those expenses had most unjustly to be paid out of the private purses of those who had endeavoured in the public interest to promote or oppose a bill. In the year 1872 an Act was passed by Parliament to amend that which was acknowledged to be a great anomaly. That Act, however, we are free to acknowledge has operated in many cases injuriously to corporations, and we have no objection to its being so amended as to relieve local authorities from the liabilities to which, under its provisions, they are exposed. There are three classes of bills to which the provisions of the Act appear to apply—First, bills introduced by local authorities who already are in possession of gas and water undertakings; secondly, bills for creating rival undertakings; and, thirdly, bills for the purpose of compulsorily acquiring the undertakings of gas and water undertakings. With respect to all these three classes the Act referred to places the local authorities in the same category. We think this is unfair, and we say that, so far as concerns the first class, we have no objection to the law being amended. The Act also provides an unworkable machinery. Before a local authority can go to Parliament for the purpose of obtaining an amendment of their powers in regard to water supply, that being essentially necessary in the interest of their constituents, the ratepayers in public meeting assembled, in the manner provided by the Local Government Act, 1858, must pass a resolution authorizing the promotion of such bill. Now, inasmuch as this provision presses heavily and unjustly upon local authorities, we have no objection to its repeal, and we think we may venture to express an opinion that the law should be amended, and that that restriction should be done away. We think the local authority, being elected by the ratepayers, are competent to form a judgment upon the subject of what is necessary, especially as we have the power, should our interests be in any way attacked, of defending ourselves before Parliament. Therefore we draw a great distinction between local authorities upon whom has been placed the duty and obligation of providing gas or water for their constituents. We think that, if in their discretion it is necessary to obtain additional powers to carry on their existing works, they should be allowed to seek for such powers without first obtaining the consent of the owners and ratepayers of the district, who, as a rule, are always averse to the expenditure of money. In so far, therefore, as it may thus be thought necessary to amend the present law, we have no objection. Then, sir, in the second section of the Municipal Corporations (Borough Funds) Act, where powers are given to the governing body to promote or oppose any local and personal bill in Parliament, and to charge the expense of such promotion or opposition upon the borough funds or rates under their control, a very important proviso was introduced in the interests of gas and water companies. It is as follows:—"Provided that nothing in this Act contained shall authorize any governing body to promote any bill in Parliament for the establishment of any gas or water works to compete with any existing gas or water company established under any Act of Parliament." This proviso was simply in effect carrying out, with respect to water undertakings, the provisions of previous legislation. The Public Health Act, 1848, while it vested in local boards the right and duty to provide a supply of water for their districts, enacted that they should not construct or lay down any water-works of their own within any limits in respect of which a water company shall have been already established, unless such company shall have made default in meeting the reasonable requirements of the local board. By the proviso in the second clause of the Act of 1872, this restriction is extended to the case of gas companies, there being no Legislative obligation upon local boards to supply gas within their limits. The legislature has not thought fit, by any general statute, to entrust the supply of gas to local authorities, and such supply by them is never afforded except under special and local Acts applicable to their districts. No general obligation is laid upon local authorities, either urban or rural, to provide gas, and, therefore, whenever they do take upon themselves such an obligation, they must do so by special powers in a special Act, and the proviso which I have just read merely extends the intention of the Public Health Act, 1848, to gas undertakings. And, sir, we specially ask you, in the interests of the companies, that in any amendment of the Municipal Corporations (Borough Funds) Act you may introduce, you will still keep that provision in force, and thus carry out what we believe to be a most important principle—viz., that public money raised by the taxation of the ratepayers shall not be brought into competition with money raised by private enterprise. We say the money of the ratepayers ought not to be employed in competing with us, because, if it is, we know that we must be ruined—an unlimited supply of money raised by public taxation must always prove fatal to private enterprise if allowed to compete with it. We say it has always been a principle recognized by Parliament that the Legislature will not allow public funds to be so applied, and that, until default on our part is manifested in the discharge of our duties, we maintain that the Legislature should not interfere with us. Well, sir, I have said, in the first place, that where local authorities have already gas and water undertakings in their hands, they ought to have power to come to Parliament for all necessary powers to carry out their duties; and secondly, I say that where they have not such powers, they ought not to be permitted to interfere and compete with us. Then comes the third matter. You know there is a growing feeling in favour of the principle that gas and water undertakings should be in the hands of the local authorities. But we say it is unfair that we should be compulsorily obliged to part with our undertakings, and we would, if we thought we could succeed, urge upon you to insert a provision in any amendment of the Act of 1872, that no bill should be promoted with public funds to authorize local authorities buying our undertakings. Perhaps, however, that would be too much to expect; but in default we say that, though we are perfectly willing the local authorities should be freed from asking the opinion of the ratepayers when it is necessary to provide funds or to obtain increased powers for carrying on works already in their possession, they should be subject to the voice of the ratepayers whenever they contemplate the acquisition of undertakings, either gas or water, which are in the hands of private individuals or companies. We think that, at least, when so important an innovation upon the general law is contemplated, the voice of the ratepayers should be heard in the matter; and we ask you, sir, if you think fit to bring in a bill to amend the Act of 1872, so as to give relief to municipal and local authorities, you will introduce a provision that no bill shall be introduced by them into Parliament affecting our interests in the way I mention without an opportunity being given to the ratepayers of the district to be heard thereon. There is just one other matter. I have addressed myself hitherto exclusively to the promotion of bills. The Act of 1872 applies equally to opposition to bills. We should like, as far as we are concerned, that the law as declared in that Act should still continue to apply; but we have looked at the matter in a statesmanlike spirit, and have not been guided to our conclusions exclusively by our own interests. And we say that, inasmuch as private ratepayers cannot be heard before the House of Commons (whatever the House of Lords might do, a committee of the House of Commons would exclude them unless they represented a class from being heard)—that being the case, the local authority is the proper body to represent them, and therefore, if it be urged upon you that the propriety of opposing bills should be left to the municipal or local authority without the necessity for obtaining the concurrence of the ratepayers, we have no very strong objections to raise against it. We should prefer that the law remain as it is; but if in your discretion you think the local or other authority should be free to act, we can hardly contest the point with the strong arguments which we feel we can bring against the other propositions, because we are bound to admit that the local authorities are the proper bodies to act in the matter.

Mr. Secretary Cross: I do not contemplate dealing with the Act at all this session; but I hope, in the course of the autumn, to have time to think over it. No doubt your interests ought to be protected in all proper ways, but the main question here is between the corporations and the ratepayers. That is the main point, and, of course, this must be dealt with on broad principles. The grave question for the moment is how far the representatives of the present ratepayers are entitled practically to mortgage the property of those who come after them—for that is what it really comes to—by borrowing money, and spreading the repayment of it over a long period of years. That is a matter which requires consideration, and I can give no opinion upon it to-day; but I hope to be able to put the Act into a more workable form.

Mr. Michael: Perhaps you will say that you will allow us to see you again on the subject?

Mr. Secretary Cross: You will see the bill when it is in print, and will judge whether it is necessary. There is no question that the Act requires amendments.

The deputation, having thanked the right honourable gentleman for his courtesy, retired.

THE GAS-WELLS OF NEW YORK.—NEW PLAN OF HEATING THE CANALS IN WINTER.

The novel proposition of Mr. R. A. Cheseborough to keep the Erie Canal open in winter by means of steam-pipes laid in the canal, at a cost of 1,500,000 dols. per annum, is now seconded by Professor Charles Piagge. The latter suggests the possibility of greatly reducing the cost for fuel by making use of the immense natural supplies of gas which this State contains.

According to Professor Henry Wurtz, there are at least three belts of gas-wells running across the State of New York, from east to west. Professor Wurtz assumes the average tension of compression of the gas contained in the three gas-charged horizons (the Salina, Marcellus, and Genesee) at 20 atmospheres. Estimating the porosity of the rock at only 5 per cent. of its volume, the whole gas contained in the rock will assume at the surface the volume of the rock itself. If, therefore, the three New York belts are 200 miles long, and equal in mass to ten miles wide, and of 100 feet thickness (a moderate allowance), they will supply more than 3000 wells, each discharging 500,000 cubic feet of gas per 24 hours, for over 100 years. As, practically, 20,000 cubic feet of marsh gas (the principal constituent of the gas of natural gas-wells) may be assumed to be equal in heating capacity to one tun of anthracite, the amount of heat which could be drawn throughout the middle tier of counties in Western New York is equal to 75,000 tuns of anthracite per day, or to 27,375,000 tuns per year. Although the line of outcrop of the Marcellus formation, from which the West Bloomfield gas comes, lies south of the line of the Erie Canal, Professor Wurtz has also shown, in the same memoir, that the gas found in boring at Buffalo comes from strata lying far deeper and cropping out many miles farther north than the Marcellus; and that on the general line of the canal, the Hamilton and Salina will be found for great distances, so situated as to be reached by borings not far therefrom, and at depths which will ensure their having retained their original gaseous contents unimpaired by outcrop leakage. It may, therefore, be accepted with implicit confidence that there are throughout that part of the State large districts within which, by judicious explorations, an immense number of natural gas-wells may be developed, furnishing a fuel which raises itself out of the mine, and which may be made to transport itself to any point required. This almost inexhaustible source of fuel is the more valuable for the warming of the water in the canals, as the apparatus required can be constructed at a comparatively small expense and in such a way as not to need any extra hands for its attendance; so that the expense of keeping navigation open all winter will be confined to little more than the interest on first cost of plant, which will probably not be greater than that as estimated above for artesian wells.—*Scientific American.*

BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 839.)

Tuesday, June 9.

After the delivery of the president's address,

Mr. W. J. Warner (South Shields) read the following paper on

GAS-METERS (THE WET METER).

Mr. President and Gentlemen,—The paper which I had the honour of presenting to the association, session 1870, dealt with the three classes into which meters have been divided—inferential, wet, and dry; the elements of construction common to the two latter—valve, measure, and index; and their modifications and combinations.

An inquiry into the causes of variation in the action and registration, and an examination of the arrangements that have been devised to maintain their accuracy and efficiency, were deferred for another paper. To this we have now to direct our attention; it is a subject not only of considerable importance, but exceedingly interesting.

In the former paper an attempt was made to discover the germ of the invention, and to trace its gradual development. It was shown how beautifully the revolving gasholder of Clegg foreshadowed his gas-meter. "A hollow wheel or drum . . . . . made close on all sides to form a circular channel," this attached to a hollow shaft, passing through a stuffing-box, to form a communication between the moving chamber and the fixed pipes, being common to both machines.

A further examination of the machine will strengthen the views then advanced—

1. One of the meters was constructed without a cover or outer case, the hollow shaft, being divided into two, served as inlet and outlet.

2. The relative proportions of the annulus are nearly the same. Accum shows them to be exactly the same, and Peckstone says, "The nice adjustment of proportion is such as it would be difficult to improve. . . . . The diameter of the inner ring is 20, the outer 34 feet." Roughly, then, the annulus is one-third of the diameter; and in the chapter "On the Gas-Meter," he says, "The water in the outer case does not rise more than about one-third of its diameter."

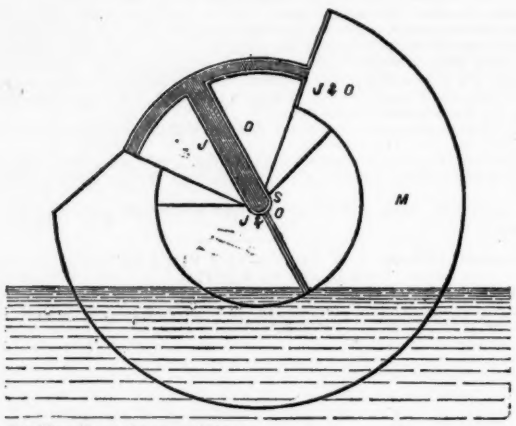
3. "Between the open and closed ends of the gasholder" the inlet and outlet pipe is placed, and it is "made of such weight as to counterpoise the interval between the two ends," so that the machine "may move in a segment of," as the wheel does in, "a circle equally, in whatever position it may happen to be placed, and hence the gas will be discharged from the gasholder with a uniform velocity."

4. "The vessel is supported at each end by friction segments," and the meter by friction wheels, upon "which the axis of the machine revolves. The advantage of this contrivance is that the friction is very much diminished."

In the revolving gasholder, not theoretically laid down, but practically carried into effect, we find three vital essentials of a gas-meter—an unvarying measure in the annular chamber, uniformity of pressure in the balance of the chamber, and the minimum of friction by the use of the segment. A continuous flow through the machine is but needed then for it to be perfect in principle as a meter. But this is *the* essential, and to it an unvarying measure had to give place, and thus was produced, and so continued to be used, defective measures, that have had to be supplemented by more or less complex arrangements to effectuate a true and a continuous measurement of gas.

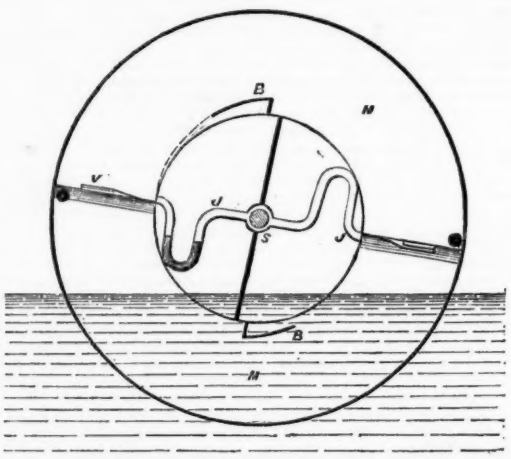
The series of working diagrams that were used to illustrate the last paper have been enlarged, the progressive steps of the invention being more closely traced. They need little description; the same letters refer to the same parts in all the diagrams—M, measuring-chamber; I, the inlets; O, the outlets; S, shaft; V, valve.

N°1



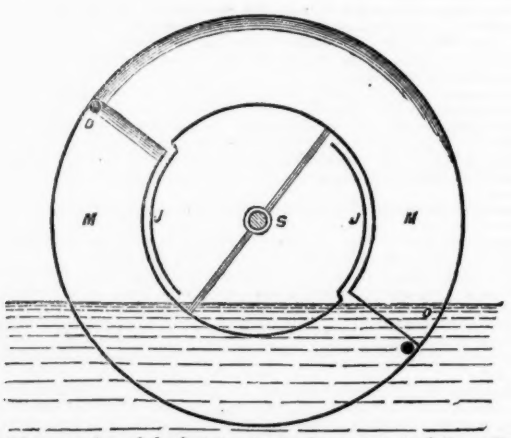
No. 1 is Clegg's revolving gasholder.

N°2



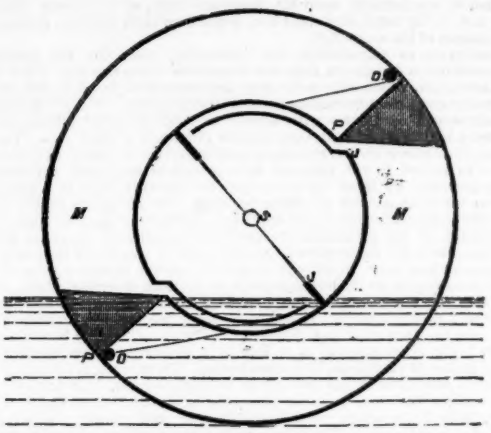
No. 2 is one of Clegg's first meters; two chambers in construction, but equal to four in action; hollow shaft, inlet to each chamber formed by bent tube, and closed by water from a bucket, B, carried round with a wheel; the valve, V, is to allow the passage of the water from chamber to chamber as the wheel revolves. Though the friction was reduced as low as possible in a meter constructed upon this principle, yet it is evident it would be very considerable. But there is a greater defect than this: the sealing of the inlet by the bucket of water, and the irregularity from this cause, and hence the necessity of change.

N°3



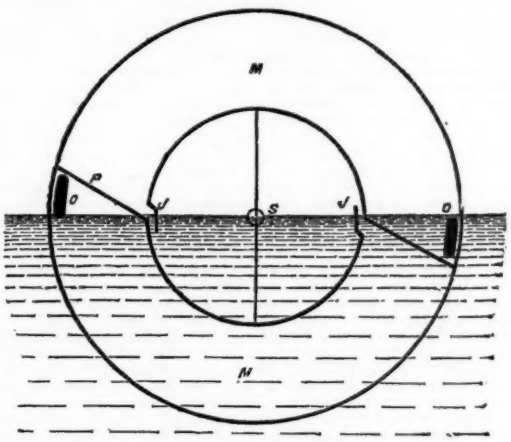
No. 3 is suggestive of the first step in the improvement of the meter dispensing with the buckets, B, carrying the inlet-pipes round the inside of centre chamber, and sealing and unsealing them by making them, as the wheel revolved, enter and leave the water in the body of the meter.

N°4



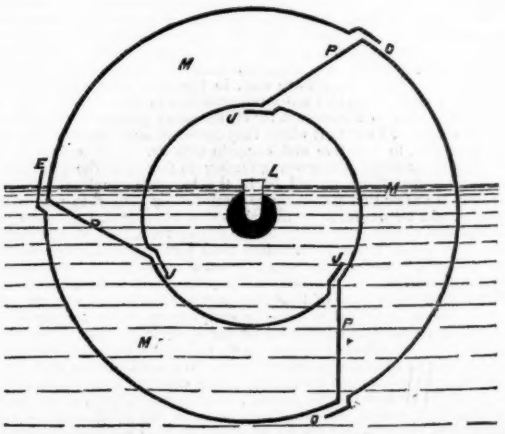
No. 4 suggests the practicability of simplifying the machine. It will be seen that by the alteration of the inlet-pipes, as in diagram 3, the water flows through them into their respective chambers, and hence arises the question—Are the valves, V, necessary? In the present form they are, as the arc of water in which they lie is but that of the pipes, therefore little more than the contents of the pipes could enter the chambers by these channels; and because each full chamber, as is shown, would have to displace some water in the body of the meter before the water could enter the chamber to displace the gas; and there would be a much larger volume of gas remaining in the corner of the closing chamber than in the original form. Two modifications, then, it is obvious, are necessary to dispense with the water-valves:—First, the alteration of the partition, P, so that it may enter the water at the periphery of the inner circle, and pass under the water at the periphery of the outer circle of chamber, thus allowing the closing chamber to be entirely emptied of gas, and the volume in the full one to be displaced as the chamber enters the water. Secondly, the shortening of the inlet passages, and the raising of the water-line.

N°5



No. 5 is constructed upon the principles just laid down. Now as each of the chambers is exactly half a circle, it is obvious that the inlet to the chamber must pass through the same proportion of a circle under the water, for the water to pass properly through the chamber. Hence the spout, the L-pipe of Malam, becomes a necessity; and also, practically, the employment of another chamber in the wheel.

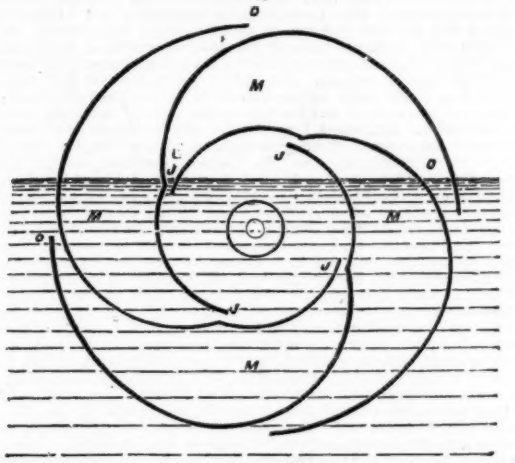
N°6



No. 6. Clegg patented with diagram 2 a three-chambered meter, exceedingly ingenious but very complicated, the chief feature being an arrangement of "scrolls" or bent pipes for passing the water from chamber to chamber, instead

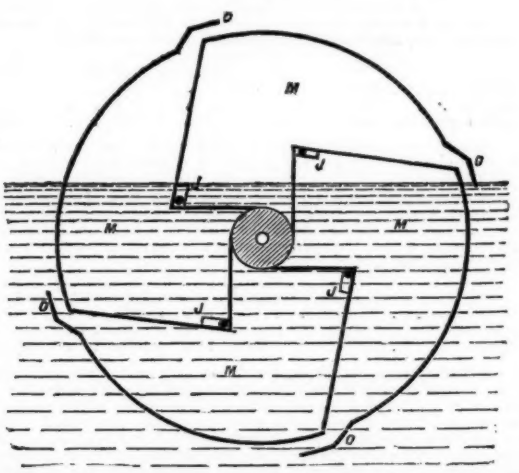
of by the water-valves. The arrangement now shown is, however, Malam's, I believe. The most noticeable point in this is the employment of outlet-hood and sectional form of outlet—that of the elongated opening, necessitated by the raising of the water-line shown in the previous diagram; also that the geometrical position of the partition is identically the same as that shown to be necessary in diagram 4. After setting out the position of the partitions in No. 5, it occurred to me to compare them with an engraving of No. 6 published some years since in the *Engineer*, and, on doing so, I found them identically the same. Allow me to give expression to the great pleasure I derived from the discovery of this and the formation of the inlet-chamber. I may also here express my great regret that Clegg did not reveal the secret history of this beautiful instrument—an instrument with which his name is inseparably connected as its inventor.

N° 7



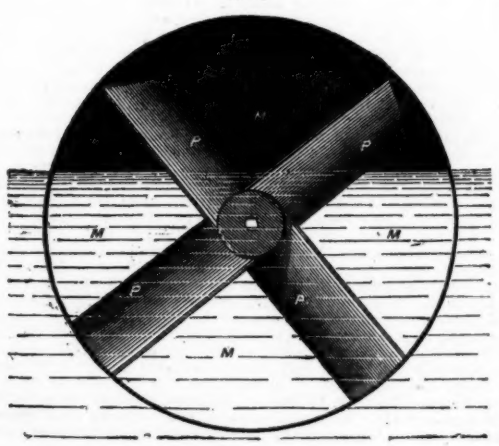
No. 7 is the next step. It was made by Malam. Four chambers are employed, and their form is altered. It was this meter that gained Malam a gold medal from the Society of Arts. It will be noticed that up to this point the principle of the original is retained—an annular chamber; a positive, fixed, and determinate measure, uninfluenced by variation in the volume of water employed.

N° 8



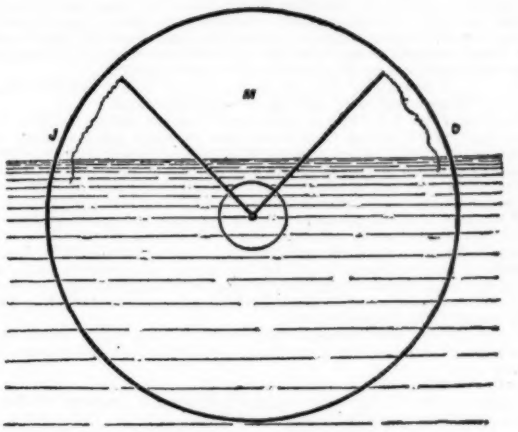
No. 8 shows the departure from this. In form it varies but little, and in detail it is not much different from No. 7, the outlet remaining the same; but the inlets are placed at the end of the wheel, the annulus being quite destroyed by the removal of the inner chamber. The object of this change was to reduce the size of meter by making the internal cylinder a part of the measure, economizing, as it were, the central space. There was also another advantage, that of allowing the water to flow more freely through what now becomes a wheel. These advantages, however, are at the cost of accuracy in measurement. Instead of the cubical capacity of the chambers being fixed, it is as variable as the water-line.

N° 9

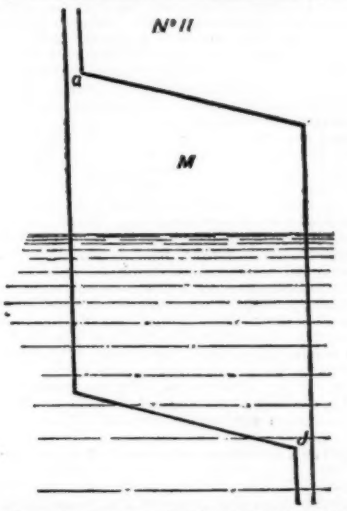


No. 9 is Samuel Crosley's wheel. The partitions are inclined across the axis, the inlet being placed under the cover with the L-pipe of Malam, and the outlets at the other end of the cylinder, being long slots from centre to periphery of wheel, and covered by hoods as in the outlets of Malam's wheel, but deeper, to allow of greater variation of water line; and in this form the meter has remained to the present time, notwithstanding many attempts to overcome the great defect inherent in the present wheel—variation of measurement. The beauty of this arrangement is not so apparent as in some of the modifications already examined, but its value is not less real.

N° 10

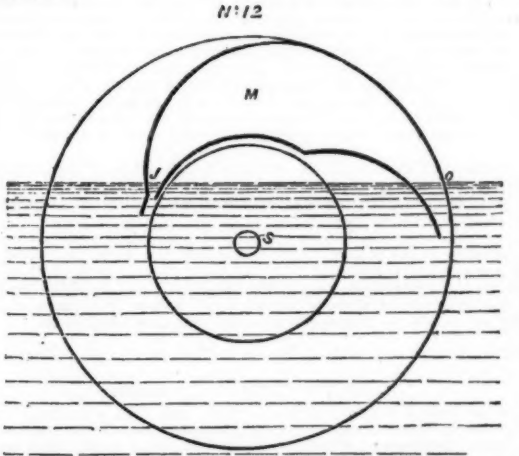


N° 11



No. 10 and No. 11 are diagrams showing the inlet and outlet hoods partly in section, by which it will at once be seen how admirably the two balance each other, and what a considerable range there comparatively is for variation of the water-line, and what an immense advantage it possesses over the former chamber, shown by diagram 12, with the limited area of action of its inlet. It is only in this form that we see the value and can appreciate the beauty of Crosley's improvement.

N° 12



The whole matter may now be briefly summed up thus:—Clegg's meter was perfect in the measurement, but defective in delivery of the gas; in Malam's the delivery was improved, but the measurement was defective; Crosley perfected the delivery, but left the measurement untouched.

"Clegg's first meter consists essentially of a cylinder divided into cells, inclosed and revolving in an outer cylinder which is *less* than half filled with water."

Malam's improvements are in the formation of the wheel, and the introduction of spout and cover, through which the gas is carried into a cylinder, revolving in water *above* its axis.

The meter, as submitted to the Society of Arts, by Malam, 1819, had its filling-plug placed at the true water-level; hence there could be no error from overcharging, and there being a float and valve attached, no gas could pass through the meter without being measured. The float and valve were in action the same as those generally used at the present time—the metal float being used in the place of a piece of cork then employed. The filling-plug having little, and but a single seal, and so being open to the whole of the water in the body of the meter, of course had to be altered, and hence arose the possibility of overcharging the meter with water. This defect was remedied some years after by the very neat arrangement of the much respected and talented engineer of the Beckton Gas-Works, Mr. F. J. Evans, who cut the spout down to the water-line, and introduced the "waste-water box."

By this means the range of error was materially limited, which again was reduced by the passing of the Sales of Gas Act. The range was so narrowed, and the action of the float became so delicate, that many ingenious arrangements were devised at the time to protect the float from the pressure of the gas; indeed, meters passing 5 feet per revolution are exempt from the general requirements of the Act, and may be used "*without float.*"

The most noticeable of these float arrangements are Mr. Pinchbeck's, employed by Messrs. Parkinson, and Mr. Cowan's side-valve.

The Sales of Gas Act, 1859, so stimulated invention that in the four successive years from the passing of it there were as many patents taken out for improvements in wet meters alone as were granted during the whole previous period of gas lighting—53 years. An examination of these will show that the current of thought was flowing in the right direction—that of measurement. Five of the number were for modifications in the construction of the drum; the chief of which were alterations in Clegg's hydraulic gas-meter, and the wheel of the ingenious Richards, with the two ends inclined inwards to the shaft. Four were for maintaining the ordinary wheel at the water-level by floats and counter-balance arrangement; 11 for fountains and water-cisterns; 10 for scoops, spoons, and mechanical contrivances for raising the water from a reservoir to the body of the meter; three for arrangements for saturating the gas, and so maintaining the water-level.

Though thought was thus stimulated and the patent trade increased, little else was accomplished by this Act—scarcely an original idea flowed immediately from it.

For the flotation of a gas-measure, and the employment of a fountain to maintain the water-line, we are indebted to the ever-active mind of Malam, to whom a patent was granted for them as far back as 1835. The scoop compensation was patented by Mead in 1851; and the beautiful idea of Sanders and Donovan, a balance-float turning on an axis, was patented in 1855; Crosley and Goldsmith's meter, 1856; the use of glycerine, 1856; Clegg's hydraulic gas-meter, 1858; Bartholomew's drum in floating case and Esson's fountain the same year. Upon the relative merits of these contrivances I am debarred from speaking by another invention recently patented, and which I hoped to have had the honour of placing before you; sufficient has, however, been advanced to relieve us from the reproach that we have wilfully used an imperfect instrument. To a gas engineer, Clegg, the world is indebted for the invention of the beautifully philosophical as well as commercially valuable gas-meter. Malam, a gas engineer, effected *the* great improvement which made the instrument a practical machine. The improvements of Crosley, who was *not* an officer of a gas company, introduced the square front and deep filling-tube by which it *was* possible to overcharge the meter. Mr. Evans, who was the engineer and is now a director of the oldest and largest gas company in the world, remedied this defect. Croll, Wright, Sanders and Donovan, Richards, and Esson all laboured, and are honourably associated with the improvement of gas-meters, and have all been engaged in the manufacture and distribution of gas. There are many others, too, who have not the less earnestly striven after a perfect meter. The great attention that is now given to distribution, from the enormous quantity of gas that, with the best of management, eludes the grasp of the gas manager, has raised the standard of perfection much higher, and demands perfect accuracy of measurement, not an approximate result. With the wet meter it has been impossible for years to overcharge the meter, and thus lessen the capacity of the measure; it has been absolutely correct on the part of the consumers; and this has been effected, too, without in the least degree adding to the mechanism of the meter. It is the same admirable machine, as simple as a grindstone, and as correct as simple—so correct that not a bubble of gas can pass through without measurement, and not a drop of water can lie between the company and the consumer to his prejudice. There is, however, between these two points—the impossibility to overcharge the meter and the passage of gas without registration—room for improvement.

As gas managers, we require a just balance, not for the consumer—he has had it for years—but the shareholder. As it is impossible to overcharge, so should it be impossible to undercharge, without lessening the admirably simple character of the machine. From my inability to place before you the invention to which I have already alluded, and debarred, as I must be, from the discussion of the relative merits of the modern improvements to which I have had to refer, the paper has assumed, perhaps, too much of the abstract and too little of the immediately practical. The value of these studies, however, in this respect, I hope, will not be overlooked, nor the suggestive character of the working diagrams which I have had the pleasure of placing before you. As an instance of this, I would just point out the identity of the partitions in diagram 8, from centre to inlet openings, with that of the inlet hoods in Wright's wheel with the corners cut off; and, again, the chamber No. 12 of Malam's meter is the type of Clegg's chamber in his "new hydraulic meter," being nearly the same in form, and precisely the same in construction and action.

In conclusion, I have to ask, on behalf of the patentees of the invention to which I have alluded, your permission to allow the drawings and their description similar to that of the specification, to be added to this paper in the printed report of the present proceedings.

The PRESIDENT said he had listened with considerable interest to the paper, and especially to one remark which had struck him particularly—viz., that while the meter of the present time was so constructed as to afford absolute protection to the consumer against overcharge, there was certainly a necessity that something should be devised which would protect the gas company from getting less for the quantity of gas consumed than they ought to do.

At the afternoon sitting, Mr. J. DOUGLAS (Portsea) read the following paper on

GASHOLDER-TANKS IN CONCRETE.

Portland cement concrete having for years past been extensively used by engineers in the construction of docks, breakwaters, and in the massive foundations and backings of similar works, its value as a constructive material having now being fully demonstrated, and the best methods of its preparation and use dictated by an intelligent experience, it will not be expected that I should be able in this paper to add anything new to the information we already have on the subject. Its recent application, however, to the construction of gasholder-tanks having been successful, and that success having been accompanied by a considerable economy, I propose to lay before you the results already obtained in this direction, with some notes on the methods employed and the dangers to be guarded against.

As was to be expected, there have not been wanting failures among those who endeavoured to work out an idea with insufficient knowledge and experience; but these failures are traceable either to originally defective materials or want of proper manipulation. Indeed, of all materials for construction, concrete is that which least affords a test of quality to the senses. Bricks can be judged by their colour, their weight in the hand, their ringing sound when struck; stone can be distinguished by its texture, its fracture, its colour, its freedom from faults; but the quality of concrete cannot be so tested. It requires not only inquiry into the nature of the cement or matrix and the aggregate, but skill in manipulation, both of which are beyond the eye and the ear. We can, therefore, at once adopt Mr. Hawksley's words in his report on the Chester sewage works: "As a substitute for brickwork, cement concrete may succeed well enough, *provided the persons engaged in the necessary manipulations have had much previous experience in the use of the materials, and take a real personal interest in their work.*"

In London concrete tanks have had considerable success. The merit of constructing the first belongs, I believe, to Mr. Livesey, the president, though it does not follow that others have necessarily copied his method. Indeed, it is hardly accurate to say that those hitherto constructed can be called concrete tanks; they are rather composite tanks of brick and cement. At the South Metropolitan works the lining of the tank is composed of brick, and the backing of concrete; the coping and bases of the columns are also of concrete, neatly worked over in cement. The first concrete tank at Bow was constructed with a double brick wall and concrete between, but afterwards the back brick wall was omitted, and the tanks were made of concrete, lined and bonded with brick. At Portsea, I constructed the tank entirely of concrete, but afterwards built up a brick lining to ensure a circular face, the only effect of which was to gratify the eye. Mr. Livesey is making another step in advance by building his new tank 184 feet diameter and 45 feet 6 inches deep of concrete alone, without puddle. The foundation will be on the chalk, which will tend very much to avoid settlement, and he will trust to rendering the face of the work to make it water-tight. It is an experiment undoubtedly, and may fail, though, personally, I have the greatest hope of success, and if it fail it must be remembered we learn more by our failures than by our successes. The point I wish to urge, however, is that the so-called concrete tanks have proved to be as water-tight as could be desired, and have retained their shape, though some of them were in bad ground, from which it may fairly be inferred that there is no inherent weakness in the method, though, as yet, the workmen engaged require rather more supervision and direction. Indeed, in some bad soils, concrete tanks may claim advantages over either brick or stone tanks; and especially is this the case where broad, strong footings are necessary. M. Viollet le Duc, in describing the foundations of the cathedral of Notre Dame, in Paris, gives an exact description of the effect of cement footings when he lays down the principle that "the primary condition of stability requires a foundation perfectly homogeneous and capable of continuous resistance under the surface." So much has this principle been recognized in large brick tanks, that frequently, although the walls are of brick or stone, the footings are mainly of concrete.

The great feature, however, of a concrete tank is its cheapness. In the first place, the strength of concrete is so much greater than brick and cement that it is unnecessary the dimensions of the concrete work should be more than two-thirds those of brickwork, taking, as usual, depth and soil into consideration. At the Exhibition of 1851 it was found that a beam of pure Portland cement, 14 in. long and 4 in. square, fixed at one end, bore 1580 lbs. at the other, which is about half the strength of Riga fir. The reduction in strength by mixture with sand was the subject of experiment this year by Mr. Lamb, of Newcastle-on-Tyne, who found the following remarkable results:—

	Pure.	One Cement and One Sand.	One Cement and Two Sand.	One Cement and Four Sand.
7 days	830 lbs.	550	375	77
112 days	1065 „	859	580	224
Increase per cent.	36 „	55	60	200

The inference he draws from these figures is that, seeing pure cement at seven days is ten times the strength of mortar containing one cement and four sand, and at 112 days is only five times the strength, there is good reason to believe the process continues till there is a very close approximation. In corroboration of this, Mr. Colson, of the Portsmouth Dockyard extension works, who has tested within the last few years about 80,000 tons of cement, has furnished me with the following figures respecting the relative strength of pure cement and one cement to two sand:—

	Pure Cement.	Increase per Cent.	One Cement and Two Sand.	Increase per Cent.
6 months	1200 lbs.	—	246	—
12 months	1400 „	16·6	404	64·2
3 years	1600 „	33·3	1174	377·2

These are extraordinary results, no doubt, but they are the average of many tests, and most of us will be able to appreciate them when we remember with what difficulty a piece of brick and cement mortar in the above proportions can be broken—frequently the brick gives way before the cement joint. I have at this moment a slab of concrete 10 ft. by 8 ft. 6 in. and 12 in. deep, in all 85 square feet, bearing 6 cwt. to the square foot without any appreciable strain. On the other hand, the resistance of Portland cement concrete to compression is greater than that of any of our best building materials. At nine months old the comparison stands thus upon a block showing 40 in. of surface:—

Portland stone	47 tons.
Fire-brick	50 „
York landing	96 „
Portland cement	120 „

Experiments were made by Mr. E. P. Smith, the well-known engineer, for Mr. Hawkshaw, prior to determining the foundation of the Spithead forts; so that, whether for resistance to crushing weight or to tensile strain, Portland cement concrete is stronger than any ordinary materials, and it may therefore be inferred that whatever brick dimensions may be considered necessary, concrete may be less—in my judgment, one-third may be reduced with safety.

In the second place, the material itself is cheaper. One of cement to seven of aggregate, gives a sufficient concrete, and its cost will not usually exceed 12s. per cubic yard, and where cement mills are near, as in my own case, or where the ballast is obtainable on the spot, it may be as low as 10s. 6d. per cubic yard, including cost of mixing and placing in position. If we compare this with the cost of brick set in cement, say 28s. to 30s. per yard, we can understand another important source of economy. I am indebted to the kindness of Mr. Evans for the information that the concrete tanks at Bow and Beckton ranged from £13 4s. to £14 16s. per 1000 cubic feet of *tank capacity.* The variation rose partly from the proportion of brickwork used, and partly from the fact that in some cases gravel was found *in situ*, while in others it had to be carted to the work. Mr. Kirkham, engineer-in-chief to the Imperial Gas Company, has kindly given me the figures for his company's brick tanks, showing that the cost varies from £17 to £26 per 1000 cubic feet of tank capacity. I have also to acknowledge Mr. Livesey's courtesy in placing at my disposal the details of all the tanks constructed by the South Metropolitan Gas Company, varying, for brick tanks, since 1862, from £25 11s. 6d. to £27 12s. 10d. per 1000 cubic feet of tank capacity, whereas the concrete tank, constructed in 1872, cost only £18 12s., or only two-thirds that of brick. At Portsea, one of our tanks, 158 feet diameter, in brick, cost £28 per 1000 cubic feet tank capacity, whereas the tank, 165 feet in diameter, we have just completed in concrete cost only £18. We must be careful, in considering these figures, not to make comparisons between the tanks constructed by one company and those

by another, because the circumstances of each are so different that any reasoning founded on the relative cost would be useless, but where the circumstances are nearly the same, as in the case of the South Metropolitan and Portsea Companies, the comparison holds fairly well, and may be accepted generally as about two-thirds the value of brickwork. I am informed by Mr. Wyatt that circumstances alter cases so much that he fully anticipates being able, through having good soil and material ready to hand, to complete a tank at Newcastle, 152 feet diameter, for about £10 per 1000 feet of tank capacity. It is only fair to add that these prices are generally for concrete tanks, whose walls are either of the same thickness or somewhat thicker than those of the brick tanks; and, that therefore, they convey no idea of the economy to be effected through the consideration of the relative strength of the materials.

In addition to equal efficiency and greater economy, concrete tanks present further advantages to engineers. Except one or two carpenters, and probably a man accustomed to plastering, all the workmen may be ordinary labourers. If the material be of good quality, and the men once put upon a good method of working, little more is wanted than a strict supervision. And besides, the work may proceed with great rapidity. By adding sufficient men and means, it is quite practicable in good weather to build 12 inches in height per day, though, as a rule, I prefer about 3 feet per week if time is no great object.

The methods employed in the construction of concrete tanks relate first to the shaping of the walls, and second to the preparation of the concrete. The excavation is carried on in the usual manner, either by a timbered trench for large tanks, or by total excavation and sloped sides for smaller tanks. In the Portsea tank, where the ground was treacherous, the trench was close boarded, and close boarding, as a rule, will, I think, be found desirable, because the additional cost is well compensated by the additional security. There were no footings to the pieces; but the footings of the walls were 6½ feet wide at bottom, and were placed on 24 inches of Stamshaw clay puddle, which was also carried up the back of the walls and over the bottom of the tank. In future I would dispense with this puddle, as will be hereafter explained. The concrete was placed gently into the trench, levelled and shaped by the shovels of the labourers, and lightly rammed. Throwing the concrete from a height should be avoided, because the elements of the concrete, having different specific gravities, fall in a heap together, and the cement is thus separated from the other material. The footings being laid, there are several methods of raising the walls. That adopted at first at Bow was to raise a skeleton brick frame by means of a face-wall of 9-inch brick, and a back wall of 9 inches thick, the space between them being filled by concrete; and courses of brickwork were carried at intervals across the concrete, so as to bond together the back and front walls. The tank wall was, in fact, cellular, the cells being filled by concrete. The sytem of bonding with brick at intervals has been continued by the Chartered Company, though, as the concrete by itself is stronger than the brick and cement courses, I do not see much advantage accrues, and it is, I should think, more expensive. After the first tank at Bow the back wall was omitted. Another peculiarity in the Chartered Company's concrete tanks is the use of hoop iron bands. Each stratum of hoop iron consists of 11 hoops laid concentrically and secured to each other by cross pieces to which they are riveted. These iron strata occur every 5 feet in height. It seems to me that this iron can hardly be a source of strength, as before it can come into play as a restraining force the concrete must have yielded to a small extent, and to however small an extent concrete is broken, its bond is almost destroyed—destroyed, at least, so far as to throw more strain on the hoop iron than it possibly can bear. Another objection seems to be that, as concrete is porous, unless the iron is bedded carefully in neat cement, both air and moisture will reach and rust it, and as the expansive force of rusting iron is enormous, there is a danger lest the massive wall of the tank be rent by the very means taken to strengthen it. Mr. Livesey also adopted a brick lining 9 inches thick, to shape the concrete to the curve, and he also made provision for bonding the brick to the concrete by a 14-inch course each 2 feet in height. In both these cases there seems to have been a fear lest the brick lining and the concrete should have a tendency to separate—a fear, I think, that is groundless, as in the tank at Portsea the lining is not bonded in any way. In the Portsea Company's tank the concrete walls were erected separately from the brick lining, the latter being added solely for the sake of appearance. There are several sets of apparatus made for concrete walling, such as Tall's patent, Drake's patent, &c.; but I used the arrangement shown in this model.

We had two carpenters to shift the moulds, and we put in 2 feet 6 inches at a time. I need not trouble you with the details of the tank so constructed, but can more usefully employ the time in suggesting the best method of constructing a concrete tank for either a large or small gasholder.

It is evident that the only points in a tank for a circular gasholder that require to be at the extremities of radii are where the guide-bars are fixed, or, in most cases, at the columns. Between the columns, the place may be a series of straight lines, either two or three, according to the size of the interval. This will enable the concrete walls to be erected, by the method I have indicated, with the greatest simplicity and economy. As soon as the frame is removed, and the concrete fairly hard, but not quite dry, the surface should be rendered with a coat of neat Portland cement about three-eighths of an inch thick, well trowelled till it is set. It must be borne in mind that, though neat Portland cement is quite impervious to water, mixed with ever so small a quantity of sand it is not so, and concrete will leak like a colander. The troweling must be continued until there is not the sign of a hole or a crack, and then the tank will be like an unglazed earthenware dish, and will hold water quite as well. There is no fear of frost affecting it, as the whole material is homogeneous, whereas on brick, unless very carefully worked, cement rendering is apt to become loose and fall off. To fix the guide-bars, apertures 12 inches deep may be left by means of a wooden core, and afterwards small concrete blocks, containing the bolts in position, may be fixed and grouted in. Although the figure of the tank may thus be many-sided on plan, a circular coping may be fixed, and satisfaction given to the eye by the gasholder and the tank being harmonious. It will be observed I have not mentioned puddle. I think puddle unnecessary, and frequently, especially in bottoms, dangerous, unless laid with the greatest care. It must not be forgotten that as a concrete block is simply a slab of stone, so a concrete tank so made ought to be like a basin hewn out of a solid and flawless rock. This would, of course, greatly cheapen the work. Mr. Livesey reckons that, whereas the brick-lined and puddled tank cost £18 12s. per 1000 cubic feet tank capacity, the tank he is building on this principle will not exceed £12 10s. My own calculations lead me to believe that, if we would trust a little more to the proved strength of good Portland cement, concrete tanks between 120 and 150 feet diameter need not cost more than £11 per 1000 cubic feet of tank capacity.

The preparation of the concrete is naturally that which requires most knowledge and experience. It involves, first, the selection of a good cement and a good aggregate; and, secondly, a judicious manipulation. Blue lias lime has been used for concrete; but, in addition to its tensile weakness compared with cement, it must be remembered that all limes are more adhesive than cohesive, and with them more depends on the aggregate than upon the matrix itself. Formerly Roman and Medina cements were the only other hydraulic matrices available; the latter, particularly, was used in the Thames Tunnel, and in the works of the North-Western Railway. We used a part of Medina in covering the cone; but though it is one of the best natural cements, its tensile strength at the end of four months does not exceed 150 lbs. per square inch, or about one-third that of Portland cement, and its rapid setting, however useful for protecting Portland cement in positions exposed to water, does not qualify it for concrete walling, which requires a certain amount of deliberation. Concrete tanks should, therefore, always be constructed with Portland cement, and if from any cause a good Portland cement cannot be obtained, it will undoubtedly be better to construct it of brick in the ordinary way.

The best materials for mixing with the cement are those of a porous character, such as well-burnt broken bricks or clay ballast. There is no better material than broken retorts, and the other *débris* of worn-out benches. Clean gravel and sands come next in order, and it is not necessary to pay too much attention to the particles being angular or rounded, though the former undoubtedly is the better; but great care must be taken to reject all soft or loamy matter, than which there is not a greater enemy to good concrete. Flints from the chalk are to be avoided as much as possible, and if absolutely the only accessible material, must be mixed with a large proportion of sharp sand. Most descriptions of rock well broken up, will form a fair concrete; but preference should be given to those of a porous texture. Chalk may be used if first dried at 120 degrees. In our tank at Portsea, and, indeed, throughout the Portsmouth Dockyard extension works, shingle, either dredged or taken from the shingle banks in the locality, was used, and no objection was found that it had a proportion of shells.

The proportions at Portsea were one of cement to seven of shingle. Occasionally a richer concrete may be used, but, unless with somewhat thinner walls, I do not see the advantage. If the wall is "packed"—that is, if layer pieces of material, such as bricks or broken retorts, are placed in the centre of the wall—a richer concrete is necessary, and this practice will be found a source of economy. Care, however, must be taken to surround the "packing" sufficiently to ensure its thorough incorporation. In a large job it will doubtless be found better to have a concrete mixer, such as that recently described by Mr. Stoney, of Dublin, for use in the construction of the North Wall Quay, where blocks of 350 tons were placed in the foundation. This mixer is a fixed or inclined horizontal trough, open on the top, with a longitudinal axis with stout iron blades at short intervals, which pug the materials and screw them forward. The water is gradually let on through a rose, and the first few blades incorporate the materials in a dry state before they reach the water. This mixer is driven by an engine of 3-horse power, and is said to turn out from 10 to 12 yards of concrete per hour.

In any, however, but the largest tanks, hand mixing must be resorted to. A platform, about 2 feet square, of deals, 20 should be laid on the ground to ensure the clean mixing of the materials. The measure for the material is simply a square box without top or bottom, and should contain, as a convenient quantity, about half a yard. It should be twice as many inches deep as the proportions of cement and ballast. For instance, if the cement is 1 in 8, it should be 16 inches deep. Inside, at 2 inches from the top, nail a lath all the way round; and, after placing the measure at one end of the platform, fill the box with shingle or ballast to the level of the lath, and complete with cement, striking the cement level with a straight-edge. The box-measure can then be lifted up and removed, when the cement will fall down over and among the aggregate, and the whole mass should be twice turned over *dry*. Water can then be added through a rose, and the whole turned twice over again. As little water should be added as possible, but enough to thoroughly moisten the whole mass. The concrete is then fit for use. In dry weather it will be necessary to keep the work damp, as, if there is not sufficient water to enable the cement to set—about 11½ per cent.—the concrete will be useless. It is also important to thoroughly wet the previous work on which the fresh concrete is to be laid; but, with these precautions, no one need be afraid of an unsatisfactory result.

It will have been gathered from what I have already said that the quality of the Portland cement used in the concrete and surface rendering is the principal difficulty. What I have to say on this point has probably been said a dozen times before, and in a far more effective form, but as there are few present who have had occasion to use this cement largely, the information now will not be out of place. Bad Portland cement is not only of no use, but it causes all the other value expended along with it to be thrown away. When, therefore, reliance is to be placed upon it, certain tests should be applied—not too stringent tests, as in some specifications, else the cement may either be unobtainable or obtainable only at an excessive cost, but tests which will show that it may be used with safety. The most easily applied test is that of weight, and it may be accepted that, *cæteris paribus*, the greater the weight the greater the ultimate strength. The Admiralty specification is 117 lbs. the imperial striked bushel, and I know specifications reaching as high as 120 lbs. The cement used at Portsea was from the well-known West Medina Mills of Charles Francis, Son, and Co., in the Isle of Wight, whence came a great part of the cement used in the Portsmouth Dockyard extension and the Spithead Forts, and was frequently 118 lbs. per bushel, but we were satisfied if it reached 112 lbs., and I think even 108 lbs. will yield satisfactory results. In addition to the weight tests we invariably tested also for tensile strength. Briquets having a sectional area of 2¼ inches were made up without excess of water and tested at the end of 7 and 28 days. These briquets were broken by the usual machine, and if they reached the standard of 250 lbs. to the square inch the cement was passed. It is not unusual to find 350 lbs. specified as the standard, and even 375 lbs.; but the cement is usually slow-setting and difficult to procure. In many instances, however, we found Francis's cement exceed 350 lbs. at 7 days, and I have known it at 28 days exceed the breaking power of the ordinary machine. It is well known that good Portland cement continues to indurate and attain a greater tensile strength for a long period, in some cases for three years, and I have been curious to ascertain how far the cement used by us would so continue to strengthen. I have been favoured by Mr. Colson, of the Dockyard extension works, who has tested recently nearly 80,000 tons, with the results of his tests upon this cement at varying periods:—

Name: Charles Francis, Son, and Co.

Average weight	115·274 lbs.	per imperial striked bushel.
Seven days tensile strength .	299·2 „	per square inch.
Thirty days „ „ .	417·3 „	„
Twelve months „ „ .	640·9 „	„
Two years „ „ .	675·8 „	„

It will be observed that the increase from 7 days to 30 days is 39·5 per cent., and from 30 days to 12 months 53·6 per cent.; but after 12 months the increase is only fractional. It may be that this cement, which gives only moderate results at first, reaches a high standard later; and, Mr. Colson informs me, in some cases, at the end of 12 months stood the very high strain of 783 lbs. per square inch.

A corroborating test was also made by chemical analyses, when, on an average, we found its composition to be:—

Insoluble in acid	32·90 per cent.
Alumina and oxide of iron.	14·30 „
Lime	50·0 „
Moisture, &c..	2·8 „
	100·00

The colour should be a fair bluish grey; if it is very light, it may be assumed there is free lime, if too dark, an excess of clay. The fineness is of the utmost importance; indeed, a good cement, of an average weight, may give bad results if imperfectly ground. The usual test is that 80 per cent. shall pass through a sieve of 2500 meshes to the inch, but, after a little experience, it will be easy to tell badly-ground cement by the grit felt between the fingers. The only remaining test is that for expansion in setting. This expansion is generally due to free lime, and my usual practice was to fill an ordinary pickle-bottle

with a small quantity lightly gauged, and if the bottle is uncracked after 24 hours, the cement might be passed. Frequently when the bottle cracked, we found that exposure to the air slaked the lime in the cement, and a portion of the same sample again tried, showed no symptoms of expansion. This exposure should always be undertaken with fresh-ground cements; and Mr. Bernays, of Chatham, states it has another advantage by increasing the bulk probably about 10 per cent., without diminution of strength. I have never found the bulk increase anything like so much as 10 per cent., though no doubt it does to some extent.

It is not to be anticipated that, even with all the details that could be enumerated in a paper of this character, any one entirely unacquainted with cement and concrete work could make a tank without experience, but many contractors are in the habit of working in concrete without the special knowledge which would direct them in the construction of water-tight tanks; and, in any case, the facts stated in this paper will enable the gas engineer who designs the work to exercise an intelligent supervision. No doubt brick tanks are thoroughly reliable, and many have recently been made in London and the large towns in the country which reflect great credit both upon the engineers and contractors, but the merits of a brick tank compared with a water-tight concrete tank, end when it is filled with water and covered from sight; and, if concrete tanks are equally efficient and sightly at a much less cost, it is no prophecy to say they will be much more extensively used than they have been. In any case, I have endeavoured to give a little impetus to the movement.

Mr. WRIGHT (Lewes) asked whether Mr. Douglas had any experience with Major Scott's cement, as used in the fort at Newhaven.

Mr. C. WOODALL (London) asked whether, in speaking of the cubical capacity of the tanks, the writer had taken any notice of the cone usually left in them.

Mr. DOUGLAS said he had not; the bottom was assumed to be flat in those cases.

Mr. BATES asked whether tanks constructed of concrete, if above the level of the ground, would be liable to be affected by frost?

Mr. WYATT (London) said he perhaps had had more experience in concrete tanks than any other person present, the whole of the tanks of the Chartered new works having passed through his hands. He had always advocated the use of concrete in these constructions, and, at the first, he had to accommodate himself to the variety of opinions entertained in reference to them. When he began, therefore, he had front and back walls, and concrete between; then a front wall and cross walls, for he had always had an opinion of his own that it was better to cut up the concrete into small parcels, having noticed that if put in in large masses, there was a tendency to unequal settlement. For this reason he had always adopted the cellular method of construction, which he had found to stand remarkably well without any settlement, and without any inclination to draw upon one part of the wall more than another. He was now constructing tanks of a capacity of 7 million feet, and they were all on the cellular principle. Mr. Douglas referred to the use of iron bond. He (Mr. Wyatt) considered that hoop iron was most essential in concrete walls. He found it had a tremendous affinity for cement; it did not rust; it never swelled, but took hold with the greatest avidity, and it was difficult to separate the two. They formed as it were one complete homogeneous mass from top to bottom. He confessed that he should be afraid to trust a concrete tank of very large dimensions without the use of hoop iron. He should also be afraid to trust it if the concrete were in very large masses. He preferred to cut it up into small cells. Mr. Douglas spoke of using concrete without puddle. From this practice he (Mr. Wyatt) dissented, as he did not believe it could be made water-tight for a single minute. He had built walls 10 and 20 feet thick, and yet the water came through like a sieve, and he had also been obliged to have recourse to puddle at the bottom and up the sides. If he were in a part of the country where there was no clay, and was compelled to dispense with puddle, he would put in three courses of tiles or bricks, and three courses of cement between. It was absolutely necessary to use puddle or something equivalent. If they had merely the rendering of cement, the effect of frosty weather would be to produce cracks; but if they built with 9 inches of brick, changes never took place; the work would always keep neat and clean. As to bonding brickwork into cement, he thought it was quite unnecessary, for he found, if he cut holes in the wall, he frequently had to break the bricks instead of detaching the cement joint.

Mr. COCKEY (Frome) said the paper which had been read was very suggestive, and brought before the meeting many things which would be extremely useful to them. He had had something to do in the construction and erection of tanks, not only in the works of which he was manager, but in many other places. He had seen brick tanks, puddle and cement, all of which had been doubtful to the last moment; and though Mr. Wyatt had spoken so much of the necessity and security of puddle to make a water-tight tank, he might state that he had seen tanks made and formed of three or four materials, each of which was intended to be water-tight in itself, and yet they had come back to the last facing of Portland cement, showing after all that cement might be used in a way to secure a tight tank. This led him to think that the paper just read was a very important one for gas managers, and one which they would do well to consider carefully, as it indicated a great advance in the mode of constructing tanks. He knew that where puddle was good it was very much to be relied on; but all depended upon the nature of it. They might have clay which looked very smooth and clean, and apparently capable of forming good puddle, and yet there might be in it a mixture of sand that would let the water in, and the porosity might not be discovered until too late to remedy the evil. No doubt clay might be found that was perfectly impervious, and he had seen tanks formed entirely of such clay, but its occurrence was very rare.

Mr. GARNETT (Ryde) had listened with great attention to the paper read by his old friend and predecessor, Mr. Douglas, and he wished to thank him for bringing so important a matter before the association on this occasion. He had been struck with several points touched upon by the writer, especially with the remarks made as to dispensing with the use of puddle. In those remarks he was perfectly correct; but, as he also remarked, it was very largely a question of overseership and management if the works were to be a success. He (Mr. Garnett) had recently been called upon to construct a tank at Ventnor, on most extraordinary soil. He built it entirely with rubblestone masonry picked off the shore, and inside the tank he carried up a 4½-inch wall in Medina cement. The work was quite satisfactory, which he attributed largely to the fact of the employment of workmen who understood what they were about, and who were well looked after during its progress. In truth, it came altogether to a question of supervision. In another case in the Isle of Wight he constructed a tank 71 feet in diameter. On excavating 15 feet, there was found at the bottom a layer of stone, a layer of gravel, and a layer of clay; and the job was how to make a tight tank with water pouring in through two of these. He did not have recourse to Portland cement concrete, though perhaps he should do so now; but he employed a hydraulic lime from Petersfield, in Hampshire, and put in two feet of concrete, and with that he obtained a tight tank. He believed in concrete, and his experience, in the past month especially, had led him most thoroughly to coincide in all that Mr. Douglas said. He believed concrete tanks were the right thing to make, and his experience justified him in recommending managers not to give a contractor the job at a certain price, and to take care that, if not present themselves during the progress of the work, some one should be there to look after the men, for the question of manipulation was that upon which success entirely depended.

Mr. FRASER (Inverkeithing) said he, like those who had already spoken, regarded the paper as one full of great interest, and as calculated to be very useful. He rose, however, to refer to the different circumstances in which managers were placed in Scotland. There they had plenty of good sandstone, and gasholder-tanks were generally built of that material. They had also a very excellent hydraulic cement, which was formed of lime from the mountain limestone underlying the coal formation. This lime was mixed with mine dust obtained from the riddling of ironstone, which when calcined was freed from all earthy impurities. The cement so formed was used in joining the sandstone together, and after being about a year under water, from the action of oxidation or otherwise, the most perfect hydraulic cement was obtained, so that it was much easier to divide the stones by force than to draw one stone from another. He mentioned these local circumstances, thinking them to be of interest, leaving the scientific persons present to draw their own conclusions.

Mr. FARLEY (Aylesbury) said he had another local circumstance to mention which might be of interest in reference to the construction of tanks. In the county of Buckingham, from which he came, there was not only clay, but chalk, and there was also limestone in abundance. Some two years ago he had to construct a gasholder-tank at his works, and the necessary excavation was made into a bed of solid blue clay. He did not anticipate coming in contact with such a fine seam of clay when the work was commenced, and the method of construction was therefore altered. He purposed, in the construction of the tank, to lay down, as was generally done, a cross puddle underneath the brick walls. Finding that this clay was really good and solid, he dispensed with the use of puddle altogether, and built his tank upon the solid bed of clay. He filled in the walls with the puddle taken out of the holes, and the tank was perfectly tight.

Mr. SYMS (Rochester) said he could bear witness to the possibility of dispensing with puddle. In 1869 he designed and constructed a tank 93 feet in diameter. The excavation was in the chalk, which was full of water. He pumped from the foundations for a long time at the rate of 360 gallons a minute, and the brickwork, covered with Portland cement, was taken down to the chalk. His directors then intervened, and insisted upon puddle being used to the walls of the tank. The walls were therefore puddled behind, but there was no puddle beneath the walls of the tank nor on the cone. The upper portion of the tank, for want of strength (the directors insisting upon Roman cement being employed), gave way and leaked. It had since been rebuilt in Portland cement, and was now tight; but there was nothing but the cement rendering in the inside.

Mr. BROWNING (Plymouth) said he constructed a tank, the greater portion of which was excavated in the solid rock. He cut down a nearly vertical wall, and constructed the whole of the tank with the rock stone taken from the excavation. He puddled the back of the tank, and rammed it down at the top. The wall was cemented with Roman cement, and in addition to that he laid a 9-inch wall within, and finished the tank with a 9-inch granite coping at the top. After completion, it was found that there was a leak somewhere, and the tank was emptied, when a cavity was discovered in the two feet of cement at the bottom, which was stopped up with concrete. But what he wished to come to was the use of puddle at the side of the tank. When the tank was filled, it was found that for all practical purposes it was tight, but a week or two afterwards there was a yielding of the joints at the top of the coping-stone of something like the 16th of an inch—a very minute crack. It occurred to him that though they had two feet of wall at the top, with 9-inch brickwork, it was not sufficient to resist the lateral pressure; and he found, upon examination, that in almost every case between the columns there were these minute cracks extending down to the brickwork, so that but for the puddle at the back, which made good the deficiency, the tank would have been leaky.

Mr. BATES (Worksop) admitted that puddle could be dispensed with at the bottom of the tank, provided there was a good thickness of concrete and Portland cement; but he doubted whether it was wise to dispense with puddle at the back of the brickwork.

Mr. J. METHVEN (London) said he should like to ask whether Mr. Douglas did not consider the cellular construction of concrete tanks objectionable, inasmuch as it seemed to interfere with that which was chiefly desired, the formation of a homogeneous structure.

Mr. G. ANDERSON (London) said several of the speakers had given their ideas on gasholder-tank construction generally, but it appeared to him that concrete tanks was the special subject before the meeting. Addressing himself to this matter, he would observe that it was a commercial question after all, the point to be determined being whether brick, iron, or concrete was the cheapest. He was of opinion that this depended upon location, and that, in some cases, it would be found that concrete would be cheaper than in others. He had been an advocate of concrete for the last 20 years, and he reminded the members that their cousins across the water frontispieced all their breakwaters with concrete, which perfectly withstood the action of the waves. But, as he had just remarked, whether or not it should be employed in the construction of gasholder-tanks depended entirely upon cost. He knew of positions in which it would be cheaper than anything else, because the material was to be had on the spot. If it had to be carted for a long distance, or if it was not clean and required much labour in making it suitable, a wall so constructed would be a dear one. And it was quite evident that concrete tanks could not be built upon all soils. Great care was required in the construction, or the result would be a failure. Whether puddle could be dispensed with would always be dependent upon the nature of the soil. He had built tanks with and without puddle, and in both cases had them tight. If he had to construct a tank upon soil which was not absolutely to be depended on, he should not think of building without it. At Waltham he had a tank built on solid sand; it was constructed in brickwork rendered in cement, and was absolutely tight from the first moment. He built a tank once in 40 feet of peat bog. It was built practically of concrete, for it was rubble in cement. It was tight for some time, but was not so now. During the last 16 years it had sunk about a foot on one side, and might have cracked in doing so. In that case he had not the means to build an iron tank, and he did not know that he could have done so without great risk, because an iron tank was very liable to settlement, and in settlement was sure to make a crack. He, therefore, took the material which he thought best under the circumstances, and made the tank of greater thickness than he should have done with brickwork, just for this reason, that though he did not believe concrete would "leak like a sieve" (he had seen concrete that was perfectly tight), he thought that this was the right way to do it. Wherever there was a running stream of water at the bottom of a tank, it was always necessary to put a good bed of concrete under the puddle.

The PRESIDENT thought the subject had been exceedingly well ventilated. He had himself intended to say something upon it, but one speaker had so answered another, and the paper itself was so complete, that he felt he could add nothing. He would only remark that, whatever had been accomplished in this direction, had been the result of gradual experiments, one step having been taken towards the employment of concrete for tanks, and then further and still further steps had been ventured. The matter which he had now in hand himself was perhaps somewhat risky; but he thought the saving to be effected, if successful, was worth the risk. If the worst came to the worst, he must do the best he could to make the tank tight. He had, unfortunately, had a great deal to do with leaky puddled tanks. When these tanks gave way, the only remedy he knew of was to concrete the cones and to cover the bottom and walls with a rendering of portland cement. By that means he had made them

tight. It would be a grand thing if they could do away with puddle. The only reason for using it was to make a water-tight structure; and to obtain this by other means, and get a solid, unyielding wall on a good foundation, was an object much to be desired.

Mr. DOUGLAS said he was obliged to the members who had taken part in the discussion. The points upon which any difference of opinion had been expressed were not very many. With regard to Major Scott's cement, which he understood to be prepared by passing sulphur fumes over lime, he had not had any experience with it; but, from what he had heard, he thought its cost would be a great obstacle to its use. He had already answered Mr. Woodall's inquiry as to the estimate of the cubic capacity of tanks. Mr. Bates asked whether concrete tanks above ground would be liable to be affected by frost. There was this to be borne in mind in speaking of Portland cement, that it would not take any more water than was necessary for its own setting, and therefore concrete walls, above all walls, contained the least amount of water, and were consequently less liable to be affected by frost than walls of any other description. Mr. Cockey pointed out that puddle and brick together frequently leaked. Mr. Wyatt's question, however, was with regard to good puddle. Mr. Garnett said they had no puddle at Ventnor, but that did not touch the question, as it would have done if he had relied upon an inside rendering. In reference to the observations of Mr. Fraser and Mr. Parlby as to local circumstances, he would only remark that if local circumstances made it cheaper to build in concrete, then it should be used, and that was really the point of his paper. Mr. Sims lamented the interference of his directors; but, after all, it seemed to have given that gentleman the opportunity of showing what Portland cement could do, and his own skill in overcoming a difficulty. Mr. Browning suggested a very proper question with regard to the use of a rigid material such as concrete, and its being liable to settlement, and the effects of lateral pressure, which did not come upon it until the water was in the tank. The only answer to that was the answer of experience. There was a risk of settlement, no doubt, possibly causing slight cracks; but, if the concrete was properly designed and properly put in, he had not found such a thing to occur. The whole question of success or failure in these structures rested upon due care and proper manipulation. This must always be borne in mind. At Portsea he first of all constructed the tank and then rendered it, and in all future tanks he would invariably build up the concrete walls without putting backings at all. As to the leakiness of concrete, he mentioned that he had two boxes made 12 feet square, with concrete in the proportion of 7 to 1. One of these boxes was of concrete alone, and it leaked exactly like a sieve, the water running out as fast as it was put in. The other, which was rendered on the inside with Portland cement, was as tight as a washhand basin. This was a sufficient answer to the question that, if properly done, rendering would hold water. Mr. Anderson very properly put the matter when he said it was entirely a commercial question. If concrete tanks could be made cheaper, and there was reason to believe they could be made as well, then no one would hesitate to make them; if, on the other hand, they could not be made cheaper, no man in his senses would think of trying. But he thought Mr. Anderson had to some extent answered himself. He quite agreed with that gentleman with respect to French *beton*, and he knew there was nothing new in his paper; but when Mr. Anderson said there were few places where materials for concrete could be found, he must differ from him. There were few places in England where it could not be found, and the list he gave of materials available for the purpose showed this. Of course, if material in any locality was unclean, the cost of washing it must form an element in the calculation. He questioned the correctness of Mr. Anderson's remark about the use of this material on peaty and unsafe soils. It was one of the strong points in its favour. If the soil was unequal, concrete was the best thing to employ. Mr. Stoney, of Dublin, said that where the soil was found soft in one place and hard in another he strongly recommended the use of concrete footings, so that there might be equal and fair settlement. And now he came to the question raised by Mr. Wyatt. He knew there was no man in the room who had had anything like the experience in the use of concrete that Mr. Wyatt had, and nearly all the information which he (Mr. Douglas) had been enabled to obtain with regard to such tanks in London, with the exception of what he had learned from Mr. Livesey, he had pleasure in acknowledging he obtained from Mr. Wyatt. But his experience led him in one direction, and Mr. Wyatt's in another, therefore it came to a question of fact. Mr. Wyatt objected to laying large slabs or walls of concrete without any brick bonding as being unsafe, but his (Mr. Douglas's) answer to that was that he had successfully put in long and deep walls without any bonding. The walls in his tank at Portsea were 165 feet in diameter, and nearly 30 feet in depth, and they had neither brick nor bond in them, and yet there was not the slightest trace of a settlement or a crack in them. With regard to hoop-iron bond, again he differed from Mr. Wyatt, with great reluctance and with great diffidence; nevertheless, if the members would look at the *rationale* of hoop-iron bond, they would see at once that these hoops could do little to resist a strain when once that strain was sufficient to fracture a concrete wall. He did not care how many there were; each one would have to stand a strain upon itself. On the contrary, he was satisfied that long before hoop iron could have the least effect upon the work, the bond of the work would be gone, and its usefulness destroyed. Then, too, it must be remembered that concrete was porous, and would admit both air and moisture, and unless care was taken to surround the hoop iron with neat cement, it would become rusted, and do great damage to the work by its expansion. With reference to puddle, he would only remark that cement rendering would undoubtedly make concrete, which before was leaky, water-tight. And if the cement rendering would keep the water out, there was no necessity to put anything at the back of the concrete to make certainty more certain. He had no doubt that in the result of his experiment Mr. Livesey would prove his engineering foresight to be correct, and he (Mr. Douglas) hoped next year to hear him say that notwithstanding all the vaticinations of failure, he had achieved a complete success with his concrete tank without puddle.

(To be continued.)

GREAT COGGESHALL GAS COMPANY, LIMITED.—The directors of this company have informed the consumers of gas, and the other inhabitants of the town, that they have reduced the price of gas from 6s. 8d. to 6s. per 1000 feet, for all purposes for which gas may be used.

OLDHAM CORPORATION GAS-WORKS.—At the meeting of the Corporation Gas and Water-Works committee on the 13th inst., it was resolved that £8000 of the profits arising from the gas and water-works should be handed over to the rates for the next year.

PERTH GAS COMMISSION.—The adjourned meeting of this board was held on the 12th inst., when the amended estimates for the ensuing year were approved. It was resolved that the price of gas be fixed at 7s. 1d. per 1000 cubic feet, being a reduction of 5d. from last year's price. Treasurer Martin protested against the reduction, declaring that it was made only by starving the contingency-fund. The price of gas for the village of Scone will be 7s. 11d. The committee recommended that the commission contract for 1000 tons of coal. Mr. Deas moved that the amount be restricted to 400 tons, and this proposal was carried against that of the committee. On the motion of Mr. M'Kenzie it was resolved that the Gas Committee be instructed to appoint a Finance Committee from amongst their number.

BOMBAY GAS COMPANY, LIMITED.

The Ordinary Meeting of this Company was held at the City Terminus Hotel, Cannon Street, London, on Thursday, June 18—DANIEL THOMAS EVANS, Esq., in the chair.

The SECRETARY (Mr. W. Marshall) read the notice convening the meeting, and the following report and statements of account, were submitted:—

Your directors have pleasure in meeting the shareholders, and presenting a statement of accounts, duly audited, for the half year ending the 31st of December last.

The progress of the company continues to be satisfactory.

It will no doubt be observed that there has been a decrease in gas-rental. This arises principally from the circumstance that during the corresponding period of last year a large sum was received for illumination, in honour of the visit of the Viceroy. The residual products show a satisfactory increase, as compared with the returns for the corresponding six months of last year. On fittings also there has been profit made.

The net profit for the half year is £11,692 5s.

Your directors have added to the reserve-fund £3000, making a total of £3500 thus appropriated in the year. They have written off from that fund, for depreciation, £1340 8s. 6d. in the half year, making a total of £4246 18s. 9d. in the year; leaving £5217 6s. 6d. at the credit of the reserve-fund.

The general revenue account, after payment of the interim dividend of 3½ per cent., and interest on the debentures, on the 1st of January last, shows a balance of £10,061 14s. 11d. Out of this your directors recommend the shareholders to declare a dividend of 4 per cent. (making 7½ per cent. for the year), free of income-tax. This will absorb £9600; leaving £461 14s. 11d. to be carried forward to the credit of next half year.

Notwithstanding the high price of coal, your directors have continued to supply gas of excellent quality to the public in Bombay without raising the price.

Your directors regret having to report that, owing to frauds committed by a native clerk, the revenue has suffered for several years to a small extent; but as the amounts so misappropriated were never brought into the credit of the company, the profit and loss accounts have not been affected, with the exception of £159 3s. 9d., now written off. The man was prosecuted, convicted, and sentenced to three years "rigorous imprisonment."

The rates of exchange having continued seriously adverse for a long time past, a large amount of money accumulated in Bombay; this your directors have been enabled to bring over at rates which, though below par, are highly favourable, as compared with those ruling until within the last few months.

The directors who retire by rotation are Warine Bayley Marshall Lysley and William Swainson Suart, who, being eligible, offer themselves for re-election.

The auditors, Edward George Bradley and Robert King, retire from office, and, being eligible, offer themselves for re-election.

The dividend will be payable on the 1st of July next.

Dr. *General Balance Sheet, Dec. 31, 1873.* *Cr.*

Capital authorized:— (50,000 shares, at £5 each—£250,000.)				Construction account	£198,472 4 5
40,000 shares, £5 paid	£200,000	0	0	Goods *in transitu*	2,007 14 1
10,000 „ £4 paid	40,000	0	0	Services account	139 4 7
Debentures	19,650	0	0	Retort account	486 19 3
Amount owing by company	3,268	9	9	Stock in trade, viz.:—	
Dividend	8,400	0	0	Chandeliers, brackets, &c.	7,135 12 6
Reserve-fund £4,329 6 0				Brass and iron goods, tubing, &c.	6,662 17 5
Added this half year 2,000 0 0				Materials, mains, and services	1,853 13 9
Old materials sold 237 9 0				Meters	3,007 18 10
	£6,557 15 0			Coal	7,656 4 3
Writ. off meters, tools, &c. 1,340 8 6				Coke	399 3 0
	5,217	6	6	Tar	300 12 9
Insurance-fund	342	14	7	Oxide, tools, fire materials, &c.	1,183 13 6
Passage-fund	77	0	0	Amount owing to the company	6,714 16 2
Balance to general revenue	10,061	14	11	Cash at bankers, on deposit, and in hand	*35,136 11 3
				Indian Government 4½ per cent. Loan, 1872	7,000 0 0
				Bankers bills in hand	9,000 0 0
	£287,217	5	9		£287,217 5 9

* N.B.—Of this sum £8409 dividend was paid on Jan. 1, 1874.

Dr. *Profit and Loss Account for Half Year ending Dec. 31, 1873.* *Cr.*

Coal carbonized	£7,224	1	5	Gas and meter rental	£18,943	17 11
Wages	1,151	14	7	Coke	4,453	3 3
Purifying	29	3	3	Tar	608	5 1
Maintenance of retorts	97	7	10	Fittings	1,040	15 6
Trade and general charges	1,003	16	6	Interest	391	4 3
Salaries and collectors commission	1,855	9	10	Transfer fees	13	15 6
Rents, rates, and taxes	390	12	3			
Directors and auditors remuneration	626	5	0			
Bad debts and allowances	42	5	11			
Misappropriation written off	159	3	9			
Law expenses	6	4	7			
Exchange	1,142	11	7			
Net profit	11,692	5	0			
	£25,451	1	6		£25,451	1 6

Dr. *General Revenue Account, Dec. 31, 1873.* *Cr.*

Dividend for half year ending the 30th of June, 1873	£3,400	0	0	Balance on 30th of June, 1873	£9,858	19 11
Interest on debentures	589	10	0	Net profit for half year ending Dec. 31, 1873	11,692	5 0
Amount carried to reserve-fund	2,000	0	0		£21,051	4 11
Balance carried down	10,061	14	11	1874, Jan. 1.—By Balance brought down	£10,061	14 11
	£21,051	4	11			

The CHAIRMAN: Gentlemen, it gives us, the directors, no ordinary pleasure to meet you on this occasion, and to testify to the state, progress, and prosperity of the company. We are enabled, for the first time in the history of the company, to recommend you to declare a dividend of 4 per cent. for the half year, making a total of 7½ per cent. upon the year, free of income-tax. At the same time we have added to the reserve £3500 in the past year, and have written off £4246 for depreciation. The dividend we now propose has been, I can assure you, well earned; and, as I have shown, we have made very handsome provision for depreciation and for reserve. There is nothing, in my judgment, so prejudicial to the interests of a company, regarded as a property, as to have a fluctuating dividend. We have well considered the matter, and we do not recommend you to declare this 4 per cent. (making 7½ per cent. for the year) without a full assurance that we shall be able to maintain that dividend for the future. It has been my custom on these occasions to refer to the general balance-sheet, the profit and loss, and the revenue accounts, and I shall do so to-day, though I shall not have to detain you with so long a statement and comparison as I sometimes make. Turning first to the balance-sheet, you will see that in the "Construction account" there has been an increase during the year of only £70, which is quite insignificant. The "Goods in transitu" are £2003 more than they were in 1872. This is due to the shipment of coals from Australia. If you will refer to the items under the general head of "Stock in trade," you will find a decrease in the "Chandeliers, brackets, brass and iron goods, &c.," of £6255. This represents the sale of goods and the amount written off for depreciation. It is interesting to observe in the item of "Fittings" that there has been a reduction of nearly £20,790 since we began lighting. In 1867 the items were £37,595; on the 31st of December last year they amounted to £16,805. During this period the net profit on fittings account has been £5352, so that our investments in fittings have not been altogether unsatisfactory. The item of "Coal" shows a difference between the present and the previous accounts of £10,000. The stock has been reduced by consumption.

At the end of last year we had 3529 tons in stock as against 8559 tons in the previous year. During the current year we have been adding considerably to our stock. Up to the present date we have added upwards of 4000 tons, so that we have twelve months supply provided for. Our coal last half year cost us £2 3s. 9d. per ton, as against £2 0s. 11d. in the corresponding half of 1872, which I think you will say is very satisfactory, the increase being less than 3s. per ton. The cost of coal in the present half year is about the same as last. Your directors are steadily watching the freight and coal markets. The freight is the principal feature with us, and we take advantage of every opportunity to put coal into our works at a price as near to £2 a ton as we can—a price upon which we have hitherto thriven so well. Our stock of coke was less by £1000—that is an excellent feature. The demand for coke is so great that we cannot keep pace with it, and we are now indebted 300 tons to two of the great railways in Bombay. We find, too, that the demand from small consumers, who pay the highest price, is continually increasing. In fact, our manager tells us that when he leaves the works in the morning there is not an ounce of coke to be had, and the carts are there waiting for the eleven o'clock draw. I should say, also, that with regard to tar there is a considerable demand springing up, and our manager has recently raised the price of that product. The stock, as you see, was reduced by about £800 compared with the stock in 1872. The profit for the last half year was £608, which was about the same as before. Up to December last the demand for tar had increased considerably, and the price had risen. It is now from 7½d. to 9d.; we have sold it as low as 4½d. The "Cash at bankers and cash and bills in hand" was £51,136 last December, as against £32,531, the difference arising from the turning of our stock of coal into gold. On the last day of last year we had £35,000 lying in Bombay, which we had been unable to get over owing to adverse exchanges on London. During the last six months of 1873 the rate for bankers bills was 1s. 10¼d.—a rate which was so disastrous to us that we had to wait till better times came, utilizing the amount in hand as best we could by deposit and otherwise. To have remitted then would have entailed a loss of 7 per cent; but in January and February we were able to bring over this large sum at a rate partly at 1s. 11¼d. and 1s. 11½d., thus effecting a saving in the operation of 5 per cent., which amounted to about £1500. The six months bills are now running off, and have nearly all arrived at maturity. As I said, the cash and securities amounted to £51,136. This appears a very large sum, and you will naturally inquire how we shall deal with it. Well, you will remember that we have debentures to pay off amounting to nearly £20,000; we have also coals to ship and dividends to pay. In these ways we shall dispose of this very large balance. If you turn to the profit and loss account, you will find almost every item in favour of the company. First there is the "Coal carbonized." It is a very remarkable coincidence that, in the half year ending December, 1873, the cost of coals carbonized was exactly the same as in the corresponding half of 1872—viz., £7224. On the other hand, I may tell you that we consumed 225 tons less last half year, but then the price was higher. This reduction in quantity is a very gratifying fact, as showing that we have improved considerably in our mode of carbonization. "Wages" are in favour of the company, being £1181 against £1386; "Purifying" is about the same—£29 against £27; "Maintenance of retorts," £97 against £112; "Trade and general charges," £1003 against £1232; "Salaries," £1855 against £1823, a merely nominal increase; "Rents, rates, and taxes," £390 against £586; "Directors and auditors remuneration," £626 against £601; "Bad debts and allowances," £42 against £47. And I may here remark that I do not know of any company, whose transactions are as large as ours, in which the bad debts are so small as during our entire history they have been with us. "Law expenses" last half year were £6 against £31 in the corresponding half of 1872, and the net profit of the working was £11,692, as against £11,596.

A SHAREHOLDER: What is the amount of the misappropriation referred to in the report?

The CHAIRMAN: About £700. We have prosecuted the delinquent, who was found guilty, and is now working out his sentence. During the time that these misappropriations were going on, we divided so much less profit, so that £159 3s. 9d. is in point of fact the whole that we have lost during the half year; the remaining £540 never having been brought into credit, we have never felt the loss. On the other side of the account you will perceive that the "Gas and meter rental" shows a decrease of £659; that has been accounted for in the report. It arises principally from the circumstance that during the corresponding period of 1872 a large sum was received for illuminations in honour of the visit of the Viceroy. The increase in the returns for coke last half year, as compared with 1872, was no less than £1044; in tar there was a slight decrease of about £16, and in fittings an increase of £74. With regard to "Coke, tar, and fittings," I group these three items together; they show a profit of £6102; a circumstance quite unprecedented in the history of the company. The profit on fittings, £1040, is especially gratifying, and our manager reports that he is still busy. The leakage, which was reduced to 7 per cent., is now 10 per cent., and that is, I am advised, quite as low as can be expected under the circumstances. Our manager writes us very fully as to the state of the works; in substance it comes to this, that the works, mains, and services, are all in excellent condition. There is something very gratifying in regard to the public lighting. The report of the municipal commissioner to the Corporation of Bombay shows how thoroughly satisfied they are with the manner in which we carry out our contract. [The Chairman read extracts from the report.] You will observe from these extracts that it is only because the funds placed at his disposal are insufficient, that the municipal commissioner does not enter into arrangements for extending the public lighting; but we cherish the hope that next year we shall have a contract for some extensions at all events. As regards the future of the company, I think our prospects are very cheering. I hold in my hand a comparative statement of the working of the company from the beginning of January until April last, showing upon the four months an increased profit in round numbers of £1500, and I have no doubt that, when the accounts are made up, these results will be substantiated. During the current half year, the profit on the first four months is £1500 more than in the first four months of 1873. I do not know that I have any further remarks to make, and therefore I will move—"That the report and statements of account, circulated among the shareholders, be received and adopted; and that a dividend for the half year ending the 31st of December last, of 4 per cent., free of income-tax, be now declared, payable on and after the 1st of July next."

Mr. LINGING seconded the motion, and congratulated the directors and shareholders generally upon the satisfactory state of the affairs of the company. He remarked, however, that there were two items on the debit side of the balance-sheet which, in his opinion, were misplaced. The first was in the item of "reserve-fund," to the credit of which had been carried a sum received for "old materials sold." He thought that amount ought to have gone to profit and loss. In the second place, there was deducted from the reserve-fund a sum "written off meters, tools," &c. Should not that item also come against the revenue? On the other side of the account he objected to the memorandum at foot, the necessity for which he remarked would be removed by paying the dividend on the 31st of December instead of the 1st of January, and the account would then require no explanation. Upon a former occasion he understood the chairman to state that the directors had entered into a new contract with the municipality for the public lighting, which he predicted would be of a highly satisfactory character to the company. Perhaps the chairman would now state what the results actually were.

The CHAIRMAN said he did not state that the directors had absolutely entered into a fresh contract, but that negotiations were at that time proceeding; that the terms had been nearly agreed upon, and the board had every reason to believe the results would be highly satisfactory. The manager had been repeatedly in communication with the Municipal Commissioner, and expected that there would be an extension of the present contract for a term of seven years, and an enlargement of the area of supply. The report of the commissioner, from which he (the chairman) had quoted, stated that it would require one lac of rupees (£10,000) to supply all the lighting for which applications had been made. The matter was still in abeyance, as it was only a question of obtaining the necessary funds, and the directors still entertained the hope that the contract would be extended as he had indicated. With reference to Mr. Linging's objections to some items in the accounts, he thought he could satisfactorily answer them. First, as to the carrying of the value of old materials sold to the reserve-fund; the directors gave great consideration to the question, and they came to the conclusion that the £237 should be so disposed of. As to the memorandum on the opposite side of the account, that also was well discussed by them, and it was felt to be most desirable to give that explanation on the face of the balance-sheet, because it *pro tanto* reduced the large sum of £51,136 which they had in hand.

Mr. LINGING said he should prefer to see the dividends paid on the 15th of June and the 15th of December, and saw no reason why it should not be so arranged.

The CHAIRMAN said the board would take the matter into consideration, and probably they would be able to fall in with the views of the honourable proprietor.

Mr. STEPHENSON said he should like to offer a little more explanation upon the point raised by Mr. Linging as to the "old materials sold" being added to the reserve-fund, and the "meters and tools" being written off it, because he differed from the opinion expressed by the honourable proprietor thereon. The company had a lot of meters which had never been used; they were purchased originally from the London Meter Company, a company now in course of liquidation, and they stood in the capital account at the sum paid for them. As they were in the way at the works, the directors thought it better to have them broken up, and write off the capital account for depreciation the sum they originally cost, and to credit the reserve-fund, from which the depreciation was taken, with the value of the materials melted up and sold.

Mr. LINGING expressed himself perfectly satisfied with the explanations given.

Mr. SEWELL said as there was at one time some little difficulty with the municipality, it would be satisfactory to the meeting to be assured that all things were now going on smoothly. He should like also to hear from the chairman the description of fittings now being sent out. He understood the chairman to say that there was a stock of coals in hand sufficient for the next twelve months. Taking that into consideration, he would ask whether the board thought it advisable to enter into any further coal contracts, and also whether they had any intention of increasing the price of gas. Bearing in mind what was said in the report respecting the defalcation of a clerk of the company, he hoped stringent means would be taken to make it practically impossible that such a circumstance should occur again. With regard to the extension of lighting, he inquired whether, in the opinion of the board, it was a desirable matter, and remarked that as it involved some serious considerations, he apprehended the directors would not enter upon it without reference to the shareholders.

The CHAIRMAN, in reply to the questions just asked, said since the new commissioner had been in power, there had been no delay in the payments due from the municipality to the company. Every month, as soon as the account was presented, it was paid. The directors were on the most friendly terms with the municipality; and the report from which he had quoted showed how thoroughly satisfied that body was with the way in which the company carried out their contract. And he might inform the meeting that when the municipality were in arrear to the company some years ago, they paid interest on the sum due at the rate of 9 per cent. for every day they were in arrear. As to fittings, the directors were now only sending out those things that were indented for and absolutely necessary. With regard to contracts for coals, they were watching the freight and coal markets in the interest of the company, so as to make such provision when prices were low as to enable them to tide over any future difficulty from advanced rates. As to increasing the charge for gas, they had been very anxious to avoid it, and, as he thought, wisely so. They were now charging nominally 14s. per 1000 cubic feet, and it would be suicidal to increase that price unless absolutely unavoidable. Referring to the fraud in the office, the directors had made every provision in their power to prevent a repetition, and as to the extensions, that was a matter entirely in the hands of the municipality, and wherever they chose to require mains to be laid, they would pay for the gas supplied according to the contract price. In answer to further questions the chairman stated that the profit on fittings arose partly from the sale of old stock and partly on new stock sent out. The number of private consumers was slightly on the increase, and there was a larger number of meters now in use than ever. The directors required and took a guarantee from all their collectors, and indeed from every officer dealing with money; but they had none with the clerk who committed the fraud, because it was no part of his duty to receive money.

The motion was then put and agreed to, and the retiring directors and auditors were severally re-elected.

Major SUART and Mr. R. KING respectively acknowledged for themselves and colleagues the compliment thus paid to them.

The CHAIRMAN: I should like just to refer to our officers in Bombay. We have there a most active, zealous, and indefatigable manager, and I am glad to have an opportunity of bearing my testimony to his ability. I think it would not be unacceptable if we passed a vote of thanks to the manager and officers in Bombay.

Major GORDON: I shall have pleasure in seconding such a vote, including in it the name of Mr. Marshall. He has been secretary of the company from the commencement, and has been a great help to the board. Considering the very able way in which he has performed his duties, we cannot do less, I think, than include his name in this vote of thanks.

General RIGBY: I think we should give these gentlemen some substantial mark of our approval, and if the meeting agree with me, I shall move that, in addition to the vote of thanks, we present to Mr. Marshall and our manager in Bombay one hundred guineas each. This is the first time we have declared a dividend at the rate of 8 per cent., and this prosperous state of things is very much owing to the energy and ability of our chief officers.

Colonel BEVILLE: I shall be glad to second the motion as far as regards Mr. Marshall; but with reference to the manager in Bombay I think it would be better to leave the matter in the hands of the board.

Mr. STEPHENSON: It is right, before the shareholders come to a vote, they should know that all our officers receive bonuses in proportion to the dividends we pay. I do not say this to discourage the passing of the resolution, but that the meeting may be in possession of the facts of the case.

The CHAIRMAN: I can only say that I entirely approve of the proposal to give one hundred guineas to our excellent secretary, and to our manager in Bombay—Mr. Walter Scott. I have no doubt that the vote will be very acceptable to both, more especially as an evidence of the appreciation of their services by the proprietors.

The motion, as amended, was put, and carried unanimously.

Mr. MARSHALL: I am greatly indebted to the honourable proprietors, the mover and seconder of the resolution, for having brought my name before the meeting, and for this unexpected and substantial recognition of my services. On no former occasion since the formation of the company, 12 years ago, when

I received a vote of thanks from the proprietors, have I been more pleased than I am to-day, when the highest dividend hitherto attained has been declared. If I have in any way contributed to so desirable a result, it has simply been by carrying out the instructions of the directors, who alone are entitled to the credit of the dividend which has been earned. With regard to the management, all that I have to say is that as the chairman has so fully adverted to the capabilities of our manager in Bombay, it only remains for me to remark that the other members of the staff generally are possessed of great energy and perseverance; and that, if industry and economy are sufficient to make this company a permanent success, that success is as good as assured. Again I beg to thank you for the honour you have done me.

On the motion of Mr. STOKES, seconded by General RIGBY, a cordial vote of thanks was given to the chairman and directors.

The CHAIRMAN: Gentlemen, on behalf of my brother directors and for myself, I beg to offer our best acknowledgments to you for the vote of thanks you have just passed. We have done our duty, I presume to say, in the past; we shall endeavour to do it in the future, and the assurance that our exertions are appreciated by you is a very great satisfaction to us.

The proceedings then terminated.

MALTA AND MEDITERRANEAN GAS COMPANY, LIMITED.

The Ordinary General Meeting of Shareholders of this Company was held yesterday, at the Offices, No. 60, Gracechurch Street—Lord ALFRED HERVEY in the chair.

The notice convening the meeting having been read, the report and balance-sheet were presented, as follows:—

The directors present their report and the balance-sheet of the company for the year ending March 31 last.

The balance of general revenue, after paying interest on debentures, and writing off £386 0s. 2d. from preliminary expenses, is sufficient to meet the dividends on the first and second preference shares, and leave £695 3s. 9d., which the directors recommend should be carried forward.

The difference between the cost of coal in the past year and the preceding is £2203 7s. 8d., equivalent to nearly 3 per cent. on the ordinary shares of the company. This increased cost of coals has unfortunately not been attended with any commensurate increase in the value of residual products.

On the 1st of July, 1873, the price of gas to private consumers at Malta was raised 1s. 6d. per 1000 cubic feet, and on Oct. 11, 1873, a similar increase was conceded by the military and naval authorities. On Dec. 1, 1873, the price to private consumers at Corfu was also raised 1s. 6d. per 1000 cubic feet.

The benefit arising from this step at Malta has been greatly counterbalanced by diminished consumption, owing to some extent to the increased price, but mainly to the slackness of trade, and the loss by fire of the opera house, which building will be restored and reopened most probably in October next.

The consumption of gas at the Sicilian stations shows a small increase.

The expenditure on capital account during the year embraces the completion of the purifying plant, and tar and ammoniacal liquor apparatus at Malta.

Of the second preference shares recently authorized, 2288 have been issued, yielding £6540. The directors will make further allotments of these shares from time to time, in order that debentures falling due may be met in those cases where renewal cannot be obtained on terms more favourable to the company than cancellation.

The retiring director is Samuel Andrews, Esq., who is eligible, and offers himself for re-election.

The auditors, Henry M'Lauchlan Backler, Esq., and James Le Geyt Daniell, Esq., also retire, and likewise offer themselves for re-election.

Dr. *General Balance-Sheet, March* 31, 1874. *Cr.*

Capital—				Preliminary expenses and sundry accounts (balance)	£772	0	7
£5 per share on 15,000 ordinary shares	£75,000	0	0	Outlay at the stations	131,808	8	1
Less discount on shares authorized, 1868	3,000	0	0	Suspense accounts	268	8	6
	£72,000	0	0	Commission on debentures and shares (balance)	359	11	2
£5 per share on 6000 preference shares (7 per cent.)	30,000	0	0	Furniture, London office	94	15	1
£1 per share on 1225 2nd preference shares (7½ per cent.)	1,225	0	0	Goods in transit	894	5	6
£5 per share on 1063 ditto	5,315	0	0	Sundry debtors	6,770	7	2
Loans on debentures	45,000	0	0	Bills receivable	3,017	18	0
Bills payable	4,025	10	5	Stocks	14,385	7	0
Sundry creditors	1,789	7	0	Cash	3,988	13	10
Reserve-fund	1,199	10	9				
General revenue	1,803	6	9				
	£162,357	14	11		£162,357	14	11

Profit and Loss, for Twelve Months ending March 31, 1874.

Coal	£10,522	10	10	Gas	£20,068	1	2
Gas-making (salaries and wages)	2,407	12	4	Coke	3,019	10	10
Charges on street lights	1,191	9	5	Meters and fittings	613	6	9
Wear and tear	1,275	4	9	Stock	136	14	9
Lime and purifying	147	8	5	Transfer fees	5	0	0
Rents	42	15	6				
Stoves	13	13	11				
Tar	3	18	7				
General expenses	672	10	7				
Bad debts and allowances	46	8	5				
Income-tax, paid in Sicily	52	17	10				
Audit fee, Malta, two years.	42	0	0				
Treasurer's commission at stations	242	11	6				
Preliminary expenses and sundry accounts, instalments of	386	0	2				
London expenses	1,033	9	7				
Exchange	322	16	0				
Interest on debentures	2,832	3	6				
Interest and discount	286	15	4				
Income-tax (balance)	58	4	3				
Revenue	2,262	2	7				
	£23,842	13	6		£23,842	13	6

General Revenue Account.

Dividend on preference shares (7 per cent.), paid in Dec., 1873, on account.	£1,050	0	0	Balance from last account, after payment of dividends	£591	4	2
Balance	1,803	6	9	Profit and loss	2,262	2	7
	£2,853	6	9		£2,853	6	9

The CHAIRMAN, in moving the adoption of the report, pointed out the severity with which the exorbitant rates for coal had pressed on the company during the past year. Other circumstances had also operated unfavourably—the loss by fire of the opera house at Malta, and the absence of the fleet from that station. The price of gas had been increased both at Malta and Corfu, but the old rates would be most cheerfully resumed when coal should recede to anything like former rates. Prospects were brightening, and the results of the current year would probably compare favourably with those of the past.

The report and accounts were adopted. Dividends on the two classes of preference shares were declared, and a vote of thanks to the directors, moved by Mr. STOKES, closed the proceedings.

REDUCTION IN THE PRICE OF GAS AT BRIGHTON.—The Brighton and Hove Gas Company have announced that on and after the 8th of July they will supply gas to the town at the rate of 3s. 6d. per 1000 feet, instead of 4s., as heretofore.

IRON AND COAL TRADES OF SHEFFIELD, NORTH DERBYSHIRE, AND SOUTH YORKSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There is very little change to report in connexion with the local iron trade, which remains in quite as dull and unfavourable a condition as heretofore. There are very few new orders, and those of but slight calibre. Pig iron of all descriptions is stiff in price, not because there is a sustained demand, but owing to the very small production in Cleveland and other iron districts. Average quotations are now: No. 1 foundry, 87s. 6d.; No. 2 foundry, 82s. 6d.; No. 3 foundry, 80s.; No. 4 foundry, 72s. 6d.; No. 4 forge (grey), 65s.; No. 5 forge, M, 62s. 6d.; No. 6 forge, W, 57s. 6d.; refined metal, 85s.; Kentledge, 77s. 6d.; and cinder, 50s., net cash, f.o.b. in the Tees. The founders are fairly well employed on the various classes of work to which allusion has been made on previous occasions. Most of these establishments in the Rotherham and Barnsley districts are making full time on colliery castings and general pipe work.

The first annual report of William Corbitt and Company, Limited, Masboro' Iron, &c., Works, Rotherham, was issued on Friday. It states that owing to there having been a strike of workmen during the greater part of the second half year, the turnover has been very much restricted. The net profit is, therefore, only £661, after making due allowance for maintenance of plant, &c. Despite this, the guaranteed dividend of 10 per cent. will be paid. Several other reports of companies engaged in the iron trade have been issued during the past few days, in most cases showing either a very small dividend, or a positive loss on the year's trading. Thus, Messrs. John Brown and Company, Limited, only pay 5 per cent., and Messrs. Camnell and Co., Limited, 10 per cent., while William Cooke and Co., Limited, have lost £7000, and the Charlton Iron Company, Limited, £9000 in the year. Two or three other companies have either been stopped, or are quite at a standstill.

The Rotherham and Sheffield brassworkers are doing a good business in most kinds of brassfoundry. At Rotherham, Messrs. Guest and Chrimes are turning out considerable lots of bib-taps, ball-cocks, hydrants, closet fittings, and general water, gas, and engine brasses.

There is but a moderate inquiry for coal of any quality. In steam coal there is a keen and growing amount of competition which forces down prices, but has the effect of sending a fair tonnage to Goole, Hull, and Grimsby, for shipment. During May, the tonnage of coal sent by railway from South Yorkshire and Derbyshire to London fell off very considerably.

The threatened strike of miners appears likely to be a reality, as soon as the notices shall have expired. They object to the proposal unconditionally; and not only so, but are at variance with their own leaders. In most cases the drop will be 12½ per cent., but in some it is already fixed at 20 per cent.; 300 men are out on strike at the Dodworth Silkstone Colliery, Barnsley, and others at the New Gawber Colliery, Barnsley.

THE NORTHERN COAL TRADE.

(FROM OUR OWN CORRESPONDENT.)

The coal trade of the northern district remains in an extremely quiet state. The local inquiry is moderate. In consequence of the winds having been from the north-east, light sailing ships have been kept back, and the requisite tonnage has not been forthcoming. The shipments of coal to London and coastwise has, therefore, hardly been an average. Steamers have kept several collieries going in the gas and household trades, but little coasters have been very much in request, and freights advanced considerably last week in consequence. From 6s. 6d. to 6s. 9d. per ton was paid to deliver at the wharves, and from 6s. 3d. to 6s. 6d. to discharge afloat in London river. Through this lack of demand at the collieries (with the exception of steam coals), arrangements were made for the purchase of general sorts at less than card quotations.

The long continuance of a very quiet business in most branches of the coal trade of the north is attracting a good deal of attention amongst all classes connected with the trade. The first half of 1874, which will close in a week, has exhibited little else but dull business amongst the principal local consumers of coal—the iron and the chemical factories. Neither of these trades show any symptoms of an immediate rally, and the falling off of foreign orders has been tolerably uniform, the Baltic business having been the worst that has been known for a considerable period. The pitmen, through their representative, Mr. Burt, M.P., have pretty plainly intimated that they will be no parties to the restriction of the production. During the past half year a considerable quantity of coal has been brought into the market from new outside collieries, and more will come in the next half. As these collieries have no established position amongst the quotations in the trade, they are found to be pretty keen of business, and they form a considerable obstacle to any combination of coal-owners, implied or otherwise, to force up prices. Under these circumstances, every intelligent person can see that the present low rates current for the ordinary class of coals is not likely to be much changed during the second half of 1874. As before stated, north country coals are subjected to a good deal of competition in the foreign markets from the South Yorkshire and other inland collieries, who have recently got access to shipping ports on the east coast. Foreigners have also fallen into the habit of using second-class coals instead of best, and they are likely to continue to do so.

It may be taken for granted there will be no difficulties with the pitmen during the next six months; and, if the iron miners of Cleveland get to work this week, they are not likely to go on strike in a hurry again. Merchants, under the present conditions of trade, are working from hand to mouth in their dealings with iron, and the chemical trade remains in a very poor state. There is a very fair inquiry for fire-clay goods for the Continent, but general shipments are extremely limited.

ANALYSES OF AIR AND WATER.—A memorial from the council of the Social Science Association has been presented to the President of the Local Government Board, praying for the periodical publication of an analysis of the air and water of large towns having a high density of population, for the purpose of detecting disease, and suggesting what may be needful for the protection of public health and the prevention of the spread of contagious diseases.

DUNDEE WATER SUPPLY.—At the meeting of the Water Commission on the 13th inst., the statements of accounts for the past year were submitted. They showed that the revenue amounted to £26,429, as against £24,380 in the previous year, being an increase of £2049. The expenditure last year was £23,081, as against £22,959 in 1873, being an increase of £122. The commissioners commenced the year with a surplus of £2163 4s. 6½d., and ended it with £5511 8s. 4½d., showing a clear increase upon the year of £3348 3s. 10d. This increase on the revenue arose in this way: Rates other than domestic, £1911 19s. 5½d.; domestic and public rates, notwithstanding the reduction of 1d., £197 11s. 6½d.; together, £2109 11s., but subject to deduction of £60 additional, allowed for irrecoverable. The expenditure as estimated this time last year amounted to £25,240. The actual expenditure was £23,081 13s. 3d. They had allowed £1400 for the Fithie, so that they were £758 6s. 9d. under the estimate. The estimated revenue was £25,213 6s. 8d., and the actual revenue £26,429 17s. 1d., being £1216 10s. 5d. in excess of the estimate.

BRADFORD WATER SUPPLY.—The Horton Bank, No. 2, reservoir, was commenced in November, 1869, and virtually completed at the end of last month, all the work remaining to be done being the dressing of the outer banks with soil, ready for sowing, and a good deal of this has been accomplished. The reservoir could at any time be filled to the depth of 30 feet, but the high-level drainage yields so little water in the present dry season that all the water coming

from that source has to be sent forward to Bradford for the supply of consumers, and none remains for storeage. When the "try holes" for the reservoir were sunk, no rock was found, but as the work progressed it was discovered that a mass of bastard rock, locally known as "kell," existed near the centre of the reservoir, dipping in such a manner that it would have let out the water when it rose above 30 feet in depth. The rock is very hard, varies from 12 feet to 14 feet thick, and the joints are so open that a hand may be inserted in the spaces between the stone. Hence it was necessary that a puddle-trench should be formed on the south side of the reservoir to prevent the water from passing away, entailing extra expense beyond the amount of the original contract. The trench was commenced on Monday, and is expected to be completed in about three months, as many men as can possibly be employed being put to work on it. The trench is 900 feet long, 6 feet wide, and will be from 25 to 45 feet deep, according to the nature of the strata. When it is completed the reservoir can be filled to a depth of 60 feet, and it will then hold over 200 million gallons of water. The finishing of the reservoir has been delayed, owing to the fact that Messrs. Fogg have had in the meantime to construct the Brayshaw service reservoir, with a holding capacity of 57 million gallons; and they have the credit of being the first contractors employed by the Bradford Corporation who have made a reservoir to hold water, the works previously executed by contract having had to be rendered tight by Mr. Gott, C.E., the water-works manager. No. 2 promises to be as good as the Brayshaw. There has been several feet depth of water in it for a lengthened period, and the bottom is perfectly sound. It may give some idea of the amount of labour required in the construction of the reservoir when it is known that 600,000 cubic yards of earth have been moved, a cubic yard being enough to fill a cart. The greatest height of the bank from the original surface of the ground is 125 feet, and the greatest width at the base from the inner to the outer slope is 325 feet, narrowing at the top to 12 feet on the east and west, and 17 feet on the north side. A dry wall, 3 feet 6 inches in height, is to be built on the top of the bank, as at Barden. The inner slope is 65 feet in height, and the outer bank is formed in a series of three terraces, each 33 feet in height, with a slope of 2 to 1, and the terraces are 60 feet wide. On the west side is a retaining wall of immense strength, 680 feet long, 21 feet thick at the base and 13 feet at the top, strengthened with counter-forts, or internal buttresses, 50 feet in height. The wall is finished with a heavy moulded coping, and on the outside it is of pitch-faced ashlar. The bank rises about 42 feet above the wall. The east retaining wall is equally strong. It is 436 feet long, and varies in height from 34 feet to 40 feet. The overflow is on the east side, forming two openings, each five feet wide, built of tooled ashlar, and communicating with a drain that runs round the reservoir. The outlet for the town supply is at this end, the 18-inch pipes being laid in a strong ashlar tunnel, about five feet in diameter, the water flowing into a well on the outer edge of the bank. The inlet wells are at the north-west corner, each nine feet square, built of solid tooled ashlar, three feet thick, pitch-faced on the outside, the water flowing down a stone culvert into the reservoir. The inner slope on the south side is finished with a series of terraces, the rock previously mentioned standing out like a bold promontory inside the reservoir. The roadway in front of the reservoir is being widened and straightened by the corporation, and the place is enclosed in a strongly constructed wall, 7 feet 6 inches in height. The view from the top of the bank, 910 feet above the sea level, is very extensive, extending northwards over many hills and valleys to Great Whernside, westward to the heights of Thornton Moor, north-east to Otley Chevin and the hills of Washburn, while below are the green slopes of the Thornton Valley, and to the eastward the town of Bradford, almost obscured in the clouds of smoke that rise from a myriad of tall chimneys. The works have been executed by Messrs. Fogg in the most substantial and workmanlike style, and if the reservoir gets filled next winter—the supply being derived from Thornton Moor—the people living on the high level will not suffer so much from a scarcity of water as they are doing at the present time. The contract price was £44,500, but this amount will be considerably exceeded when the reservoir is completed, owing to difficulties which could not be foreseen at the outset of the work. The works were designed by Mr. Gott, C.E., the water-works manager, and have been carried out under the superintendence of Mr. Hardwick, his assistant, with Mr. Whitfield, clerk of works, and Mr. J. B. Snowden, C.E., manager for Messrs. Fogg.

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

2049.—Lack, P. J., Westmoreland Place, London, "Improvements in valves for regulating the supply of gas, and in other fittings connected with gas-burners." June 12, 1874.

2059.—Wilson, J. H., Liverpool, "An improved double-way supply-valve." A communication. June 13, 1874.

2060.—Perrett, E., Great George Street, Westminster, "Improvements in apparatus for filtering liquids." June 13, 1874.

2061.—Perrett, E., Great George Street, Westminster, "Improvements in the arrangement of bag filters." June 13, 1874.

2071.—Rumpff, C., New York, U.S.A., "A new or improved dry process of oxidizing 'anthracene,' and improvements in the manufacture of dyes and other colouring matters from the product so obtained." June 15, 1874.

2078.—Tipping, I., Manchester, "Improvements in the construction of lift-pumps for sewage and other works." June 15, 1874.

2079.—Curie, P., Cornhill, London, "Improvements in the manufacture of anthracene." June 16, 1874.

2103.—Rafferty, T., Manchester, "Improvements in apparatus used in connecting service-pipes, cocks, and plugs to main gas-pipes." June 17, 1874.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION has been AWARDED to

GWYNNE & BEALE'S PATENT IMPROVED GAS-EXHAUSTERS,

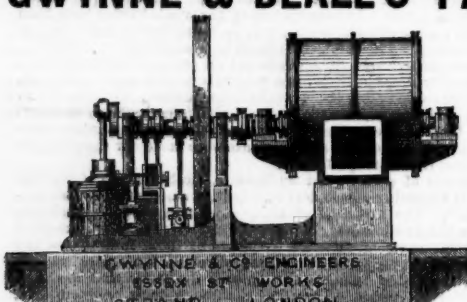


FIG. 224.

The BEST EXHAUSTERS IN THE WORLD.

Made under the personal superintendence of

Mr. BEALE,

The oldest Maker, Inventor and Patentee of

GAS-EXHAUSTING MACHINERY.

(It is NOT CORRECT to state that Mr. BEALE has RETIRED.)

Prices and every information on application.

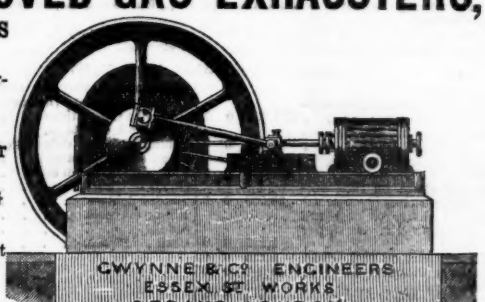


FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the most perfect system of action yet discovered. Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND Co. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the excellence of the article produced, and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

REGULATORS, BYE-PASSES, STOP-VALVES, GAS-VALVES, & MACHINERY FOR GAS MANUFACTURE, OF ALL SIZES,

CAN BE HAD ON APPLICATION TO

GWYNNE & CO., HYDRAULIC & GAS ENGINEERS, ESSEX STREET WORKS, STRAND, LONDON, W.C.

G. & Co. are now manufacturing for a London Gas Company three of their 210,000 cubic feet Patent Gas Exhausters, and many of all sizes.

WANTED, a second-hand cast-iron TANK and GASHOLDER, the latter to be in good condition, with columns, &c., complete. The diameter of tank to be from 30 to 35 ft., and 12 or 14 ft. deep. Communications to be made to Mr. ALFRED PENNY, C.E., 20, Abingdon Street, WESTMINSTER.

WANTED, an engagement as Manager or MANAGER and SECRETARY of a medium sized Gas-Work. Thoroughly understands the manufacture and distribution of gas, having had many years experience, and can give most excellent testimonials as to character and ability.
Address MANAGER, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gentleman, aged 27, a situation as MANAGER, on the Continent or abroad. Advertiser has been four years in present situation, where the make is above 90,000,000 feet per annum. Understands the manufacture and distribution of gas in all its branches. Speaks French and Italian. Leaving present situation on account of salary being insufficient.
Address SCIENCE, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

VINCENT'S
PATENT IMPROVEMENTS
IN
Apparatus for Manufacturing Gas.
Particulars to be obtained by application to—
MR. LAYARD JONES,
ENGINEER,
26, OLD BROAD STREET, LONDON, E.C.

WANTED, by a young Man, a situation as Meter-Fixer, Fitter, Index Taker, &c.
Address A. B., care of Mr. West, 84, Bunhill Row, ST. LUKE'S, E.C.

WANTED, a re-engagement as Manager of a Gas-Work. Excellent references as to character for careful and successful management. Is a fair draughtsman, &c. Accustomed to accounts and collecting.
Address J. L., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, a situation as INSPECTOR or MAIN INSPECTOR. Aged 33 years; 15 years with a London Company. Satisfactory references.
Address INSPECTOR, 15, Broadhinton Road, Clapham, SURREY.

WANTED, an engagement as Retort Setter, Foreman, or otherwise. Understands brick, iron, and clay retorts. No objection to go abroad. Excellent testimonials. Ten years in present situation.
Address R. A., 11, Botham Street, Warwick Street, Moss Side, MANCHESTER.

ADVANTAGES OF GAS
FOR COOKING AND HEATING,
BY
MAGNUS OHREN, A.I.C.E., F.C.S.

For Companies to issue to their gas consumers.
Specimen Copy by post 4d., direct from MAGNUS OHREN, Gas-Works Lower Sydenham, London, S.E.

WANTED to purchase, 5000 to 10,000 tons of GAS COKE. Waggons can be sent to any station for any proportion of above.
Address G. J. EVESON, Gas Coal and Coke Merchant, STOURBRIDGE.

WANTED, an experienced Gasman, who understands the manufacture of gas, repairing and testing meters, laying main and service pipes, fitting, &c. Wages 25s. per week from April to October, and from October to April 30s. per week. House, fuel, and gas found.
Apply, by letter, stating qualifications, &c., to the SECRETARY, Presteign Gas Company, Presteign, RADNORSHIRE.

FOR SALE, a 150-light Dry Meter, perfectly new, by one of the best makers. Warranted for six years, and stamped.
Apply to C. R., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROBUS, SIMPSON, & ROBUS,
(Late of the Crystal Palace District Gas-Works, Sydenham, and the New City Gas-Works, Montreal, Canada,)
GENERAL CONTRACTORS & RETORT-SETTERS,
FITTERS & MAIN-LAYERS.
RETORTS SET ON THE LATEST IMPROVED PLAN.
Retort-Setters sent to all parts of Europe and America.
Address, J. and H. ROBUS,
BELL GREEN, CATFORD, KENT.

THE Advertiser, son of a Gas Manager, 25 years of age, is open for an engagement, home or abroad, as MANAGER of a medium-sized, or ASSISTANT MANAGER of a large, Gas-Work. Has had 12 years experience in the gas business. Can forward good testimonials.

Address J. S., care of Mr. M'Leod, 18 & 20, Alston Street, GLASGOW.

THE Advertiser desires an engagement as Manager, Assistant Engineer, or Superintendent of a Gas-Work. Thoroughly understands the manufacture and distribution of gas, having had many years experience, and can give most satisfactory testimonials as to character and ability.

Address Y. Z., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SLIDE-VALVES.

FOR SALE—14 12-in. and 5 10-in. Slide- VALVES with outside racks. They have been thoroughly re-fitted, and are equal to new. A low price will be accepted to effect a clearance.

Apply to JAMES WATSON, Engineer and Manager, Crystal Palace District Gas Company, LOWER SYDENHAM, S.E.

TO TAR DISTILLERS.

THE Directors of the Independent Gas- light and Coke Company are prepared to receive TENDERS for the TAR produced at their works, at Haggerston, for One year, from the 31st of July, 1874.

Tenders to be sent to me, on or before Thursday, the 2nd of July, endorsed "Tender for Tar."

The Directors do not bind themselves to accept the highest or any tender.—By order,

JAMES B. COULSON, Secretary.

236, Kingsland Road, June 13, 1874.

COAL CONTRACT.

THE Commissioners acting under the Leek Improvement Act, 1855, invite TENDERS for a supply of best GAS COAL, for One, Two, or Three years, to be delivered free at the Leek Railway Station or Canal Wharf, in such quantities and at such times as may be required.

Tenders, endorsed "Coal Tender," and addressed to the Chairman of the Gas Committee, will be received not later than Four o'clock p.m., on Monday, the 29th of June inst. The lowest or any tender will not necessarily be accepted.

Further particulars may be obtained from the undersigned. C. HENSHAW, Clerk.

Public Offices, Leek, June 10, 1874.

GAS TAR AND AMMONIA WATER.

THE Commissioners acting under the Leek Improvement Act, 1855, invite TENDERS for the GAS TAR and AMMONIA WATER made at the Leek Gas-Works, for One, Two, or Three years, delivered at the works. Make of gas, 25 million cubic feet per annum.

Tenders, endorsed "Tenders for Gas Tar, &c.," and addressed to the Chairman of the Gas Committee, will be received not later than Four o'clock p.m., on Monday, the 29th of June inst. The highest or any tender will not necessarily be accepted.

The works are close to the North Staffordshire Railway and the Staffordshire Potteries Canal.

Further information may be obtained from the undersigned. C. HENSHAW, Clerk.

Public Offices, Leek, June 10, 1874.

TO TAR DISTILLERS.

THE Directors of the British Gaslight Company, Limited, invite TENDERS for the purchase of the surplus TAR (about 200,000 gallons yearly) produced at their Norwich Station for a term of years, commencing on the 1st of January, 1875. The Tar to be delivered into tank barges alongside the Company's works.

Particulars may be obtained on application to the Secretary, at No. 11, George Yard, Lombard Street, London, where tenders will be received up to Monday, the 13th of July next.

The Directors do not bind themselves to accept the highest or any other tender.

FREDERIC LANE LINGING, Secretary.

Chief Office, 11, George Yard, Lombard Street, London, E.C.

ROCHDALE CORPORATION.

TO COLLIERY PROPRIETORS AND OTHERS.

THE Gas Committee invite Tenders for the supply of CANNEL and COAL required during the year ending March 31, 1875. Full particulars may be obtained on application to Mr. Samuel Hunter, at the Gas-Works, Rochdale.

Tenders, endorsed "Tender for Cannel and Coal," must be sent to me not later than Tuesday, the 23rd of June inst.

The Committee do not bind themselves to accept the lowest or any tender.—By order,

ZACH. MELLOR, Town-Clerk.

Town-Hall, Rochdale, June 11, 1874.

BOROUGH OF BARROW-IN-FURNESS. GAS AND WATER DEPARTMENT.

RESIDUAL PRODUCTS.

TENDERS are invited for the surplus RESIDUAL PRODUCTS at their works, for One or more years, commencing the 1st of January next, comprising Gas Tar and Ammoniacal Liquor.

The quantity of each will be about 100,000 gallons per annum.

Particulars may be obtained on application to Mr. J. Lewis, Manager.

Sealed tenders, addressed "The Chairman of the Gas and Water Committee," and endorsed, to be sent in to me not later than June 30, 1874.

C. F. PRESTON, Town-Clerk.

Municipal Offices, June 18, 1874.

Will shortly be published, 12mo., cloth, 5s., post free from the Editor,

GAS AND WATER LEGISLATION. The general Acts relating to the supply of Gas and Water, with a copious General Index, affording a complete and ready reference to all the provisions of the several Acts.

Edited by JOSEPH RESON, of The (Chartered) Gaslight and Coke Company, WESTMINSTER, S.W.

WATERLOW AND SONS, LONDON.

TO IRONFOUNDERS.

THE Widnes Local Board are prepared to receive TENDERS for the supply of about 800 yards of 9-inch Cast-Iron PIPES, with plain sockets. The Pipes are to be coated both inside and outside with Dr. A. Smith's patent black varnish. The price to include delivery free on rails, at Widnes Gas-Works. Further particulars, and a tracing of the Pipes, may be had on application to the undersigned.

Tenders to be addressed to the Chairman of the Gas and Water-Works Committee, endorsed, "Tender for Pipes," and delivered at the Gas-Works, Widnes, not later than the 27th inst.

The Board does not bind itself to accept the lowest or any tender. By order,

T. A. DREW, Engineer and Manager.

Gas-Works, Widnes, June, 1874.

TO TAR DISTILLERS, &c.

THE Directors of the Kingston-upon- Thames Gas Company are prepared to receive TENDERS for the surplus TAR produced at their works at Kingston, from July 1, 1874, to June 30, 1875. Quantity about 90,000 gallons. Tenders to be at per gallon f.o.b. the Contractor's barge.

Further particulars may be obtained from Mr. Packham, Manager, at the works, where a copy of contract may be seen.

Tenders to be sent to Mr. W. A. Fricker, Secretary, Gas Offices, Church Street, Kingston, on or before the 27th of June inst., endorsed "Tender for Tar."

The Company do not pledge themselves to accept the highest or any tender. By order,

W. A. FRICKER, Secretary.

Gas Offices, Kingston, June 15, 1874.

BARROW-IN-FURNESS CORPORATION.

THE Corporation are prepared to receive TENDERS for the construction of a RESERVOIR at Pennington, and also a Tunnel AQUEDUCT between the proposed reservoir and the existing reservoir of the Corporation at Poaka Beck, together with all works in connexion with the same.

Plans, sections, and drawings may be seen, and form of tender, bill of quantities, and specification be obtained at the Office of the Engineer, Mr. Frank C. Stileman, 23, Great George Street, Westminster, S.W., or at the Municipal Offices, Barrow-in-Furness, on or after the 30th inst.

Tenders to be sent in on or before Tuesday, the 14th day of July.

The Corporation do not bind themselves to accept the lowest or any tender. By order,

C. F. PRESTON, Town-Clerk.

Barrow, June, 1874.

NEWPORT AND PILLGWENLLY WATER-WORKS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the construction of a large STORE RESERVOIR and other Works, required to contain about 160 million gallons of water, for the Newport and Pillgwenlly Water-Works Company, on their land in the Pant-yr-eos Valley, about 4 miles north-west of Newport, in the parishes of Henllis and Bassalleg, in the county of Monmouth.

The plans and specification may be seen at the Company's Offices, Stow Hill, Newport, or at the Offices of their Engineer, Mr. John Taylor, 27, Great George Street, Westminster; and sealed tenders, in the form attached to the specification, and endorsed "Tender for Pant-yr-eos Reservoir," &c., are to be addressed and delivered to the Directors, at their Offices, Stow Hill, on or before the 29th of June inst.

The Directors do not bind themselves to accept the lowest or any tender.—By order,

CHARLES CULLUM, Secretary.

Newport, Mon., June 10, 1874.

TO MANUFACTURING CHEMISTS.

THE Directors of the British Gaslight Company, Limited, invite TENDERS for the purchase of AMMONIACAL LIQUOR (about 500,000 gallons yearly) produced at their Norwich Station for a term of years, commencing on the 1st of January, 1875. The strength of the liquor to be tested by saturation, and the liquor to be delivered into tank barges alongside the Company's works.

The tender to state what price will be given per ounce of strength, commencing at 6 ounces for each butt of 108 gallons, which price is to be subject to periodical adjustment, monthly or quarterly, according to the value of sulphate of ammonia in the London market.

Further particulars may be obtained on application to the Secretary, at 11, George Yard, Lombard Street, London, where tenders will be received up to Monday, the 13th of July next.

The Directors do not bind themselves to accept the highest or any other tender.

FREDERIC LANE LINGING, Secretary.

Chief Office, 11, George Yard, Lombard Street, London, E.C.

FERNDALE GAS AND WATER COMPANY.

TO CONTRACTORS AND IRONFOUNDERS, &c.

THE Ferndale Gas and Water Company, Limited, Ferndale, near Pontypridd, Glamorganshire, solicit TENDERS for the various works to be done in the erection of GAS-WORKS.

The contract or contracts will comprise the excavation, masonry, &c., for a cast-iron Gasholder-Tank, the building of Boundary Walls, Coal Store and Retort-House, Lime-House, Purifier-House, Station-Meter House, Governor-House, Office, and other erections, together with all the Apparatus, 6-in. Connexions, and Street Mains requisite in the construction of such Gas-Works.

Full particulars may be obtained, and inspection of the plans and specifications, after the 30th inst., on application to the Company's Engineer, Mr. JOHN LEES COCKER, Gas-Works, Merthyr Tydfil.

Sealed tenders, to be forwarded to the undersigned, will be received up to the 18th of July proximo, endorsed "Tender for Excavation," "Buildings, &c," or "Apparatus," as the case may be.

Tenders may include the whole of the work to be done, but a separate sum must be stated for the excavation, the various buildings, and each portion of the apparatus and mains.

The Directors reserve the right to accept or reject any tender, whether the lowest or otherwise.

By order,

J. EDWARDS PRICE, Secretary.

The Court House, Pontypridd.

TENDERS FOR GAS COALS.

THE Directors of the Canterbury Gas and Water Company invite TENDERS for the supply of 5000 tons of best GAS COALS, to be delivered as follows:—

400	tons	during the month of	July next.
500	"	"	August next.
500	"	"	September next.
700	"	"	October next.
800	"	"	November next.
800	"	"	December next.
700	"	"	January next.
600	"	"	February next.

Persons tendering to state the name and description of the Coal proposed to be supplied, and a price per ton, free on board, or delivered at either of the Railway Stations, Canterbury.

Tenders, endorsed "Tender for Gas Coal," to be addressed to me, and delivered at the Company's Offices, Castle Street, Canterbury, before Ten o'clock in the forenoon of Friday, the 3rd of July next.

The Directors do not bind themselves to accept the lowest or any tender. By order,

JAMES BURCH, Secretary.

June 20, 1874.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

THE SECOND ANNUAL GENERAL MEETING OF THE "WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS" WILL BE HELD IN THE

TOWN-HALL, DUMFRIES,

On Friday, June 26, 1874, at Twelve o'clock Noon.

MR. WILLIAM KEY, PRESIDENT, IN THE CHAIR.

PROCEEDINGS.

Reading of Minutes; Admittance of New Members; Election of Office-Bearers for ensuing Year; Proposed Alterations recommended by the Committee, as to Meetings, Alteration of Rules, &c.; and Report as to Benevolent-Fund.

READING OF PAPERS—

Lecture by Mr. ABRAHAM MALAM, Dumfries, on "Improved Modes of Carbonizing Coal in the Production of Illuminating Gas, with One Year's Statistics, with an Examination of the Apparatus as used in Gas-Works, Dumfries;" General Discussion on Topics of Interest.

Members and Friends of the Association will dine together in the King's Arms Hotel, at Three o'clock p.m.

A train leaves Glasgow (Dunlop Street) at 9.10 a.m. for Dumfries, arriving at 11.44 a.m. Members can return same day by leaving Dumfries at 4.45 p.m., arriving in Glasgow (Dunlop Street) at 8.15 p.m.

THE "GAS MANAGERS BENEVOLENT FUND,"

INSTITUTED BY THE WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

OBJECT.—The object of the Benevolent-Fund shall be to afford assistance to necessitous Managers (in any Country) and their Families, and to the Widows and Families of deceased Managers, whose death may be caused by accident in discharge of duty, or from natural causes, and for relief in other cases requiring attention.

Amounts received since publication of last list:

Robert Darney, Manager, Gas Co., Faversham, Kent	£1 0
Joseph Aird, Esq., Wellington Tube-Works, Great Bridge, Tipton	2 2
John Lees Cocker, Esq., Engineer, Gas-Works, Merthyr Tydfil	1 0
Helensburgh Gas Company	2 2
Messrs. Strode and Co., 19, Osnaburgh Street, Regent's Park, London	1 0
Messrs. Austance and Co., 81, Gordon Street, Glasgow	1 0
Drumpark Coal Company, 16, Bothwell St., Glasgow	1 0
James Anderson, Esq., Messrs. H. Balfour and Co., Durie Foundry, Leven	1 0
Messrs. James Miller, Son, and Co., 75, Union Street, Glasgow	1 0
Messrs. J. and J. Braddock, Globe Meter-Works, Oldham	1 1
William Drummond, Esq., Manager, Gas-Works, Coatbridge	1 1
John Lawson, Esq., Secretary to Gas Company, South Shields	1 0
Thomas B. Seath, Esq., Sunny Oaks, Langbank	1 0
Wm. Brodie and Co., Caledonia Iron-Works, Paisley	2 2
William Williams Box, Esq., Manager, Gas-Works, Crayford, Kent	1 0
Gavin Paul, Esq., of Wilsontown Gas-Coal Works, by Carnwath	5 0
Henry Cadell, Esq., Grange, by Boness	1 0
William Valon, Esq., Gas-Works, Ramsgate	1 1
A. Macpherson, Esq., Gas-Works, Kirkcaldy	1 0
Robert Brown, Esq., Manager, Gas-Works, Arbroath	1 0
Arbroath Gas Corporation	1 0
Cambuslang Gas Company	1 0
Samuel Hunter, Esq., Gas-Works, Rochdale	1 0
Croydon Commercial Gas and Coke Company	2 2
	£32 11

THOMAS ALLAN & SONS, of Springbank Iron-Works, Glasgow, manufacture small cast-iron GAS AND WATER PIPES, 1½ to 6 inches, at their branch works, Stockton-on-Tees, and have at present a large stock, which they are open to sell at moderate prices

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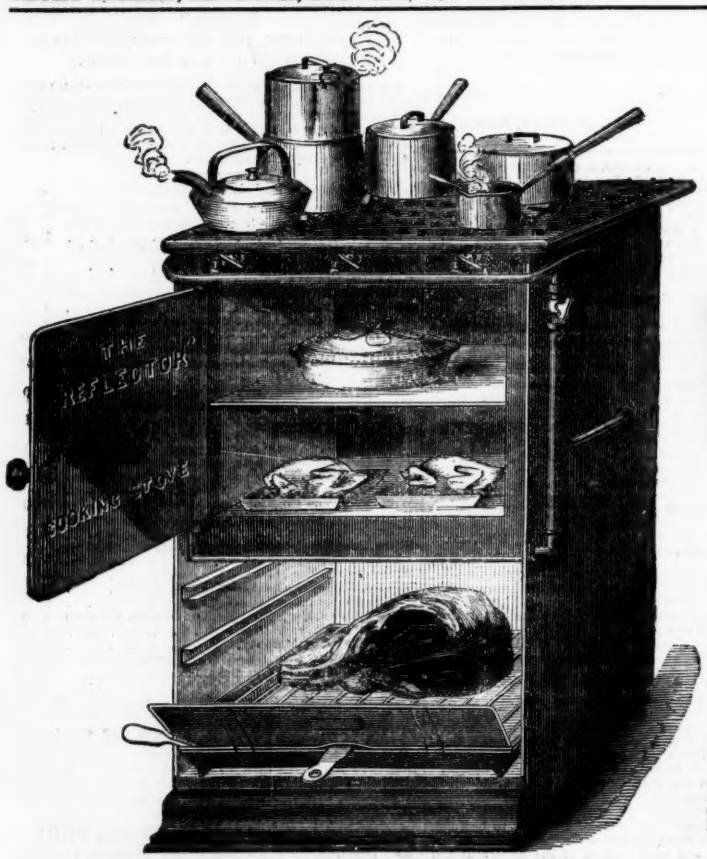

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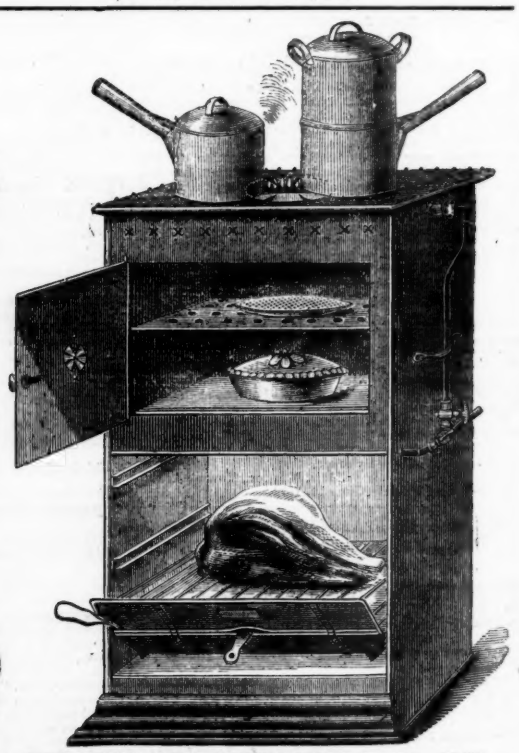

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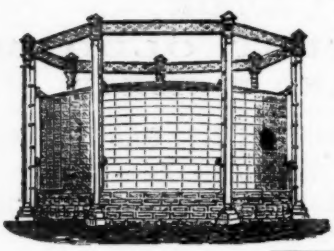

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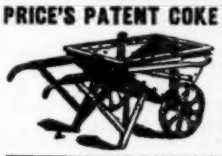

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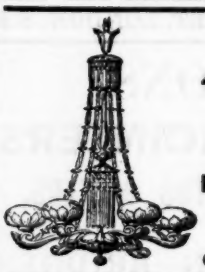
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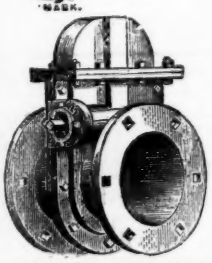
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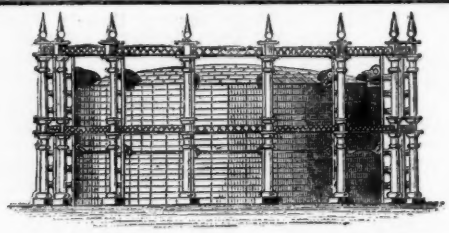
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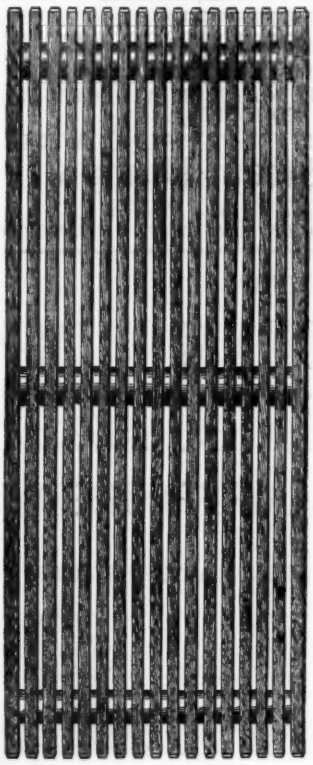

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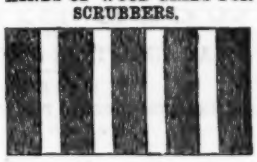

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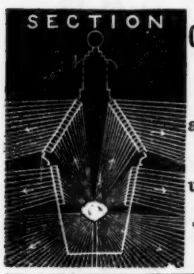

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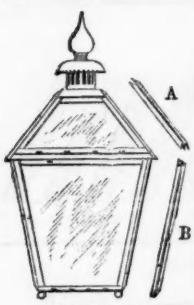

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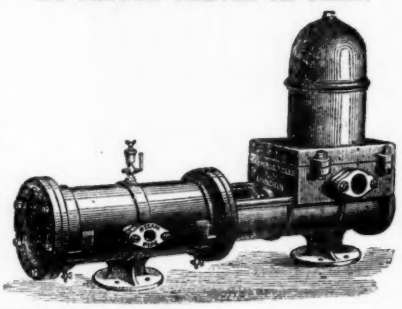

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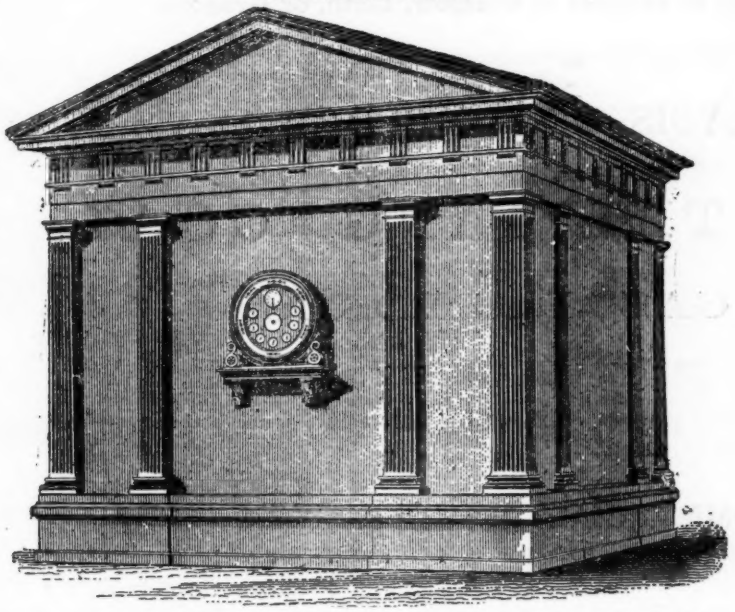

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STEAM-ENGINES and EXHAUSTERS, separately or combined.

FOUR-WAY VALVES, one of which is equal to three ordinary Valves.

STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.

N.B.—The second edition of this Work, *now ready*, contains Illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artisan.*

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Beg leave to call the attention of Gas Companies to the superior quality of their

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This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

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Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

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THE OMOA AND CLELAND IRON AND COAL COMPANY, LIMITED,

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GAS COAL

OF A VERY SUPERIOR QUALITY.

This Coal, according to the report of the analyst, yields 11,110 cubic feet of gas per ton, and has an illuminating power of 23·97 candles per 5 cubic feet per hour.

Copies of the analysis and full particulars as to price, &c., may be had on application to the SECRETARY of the COMPANY, 172, West George Street, GLASGOW.

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This Coal bears a close resemblance to the Lesmahago seam. It has a first-class Coke, equal to the Lesmahago, and greater in quantity, and 10,538 Cubic Feet of 33·2 Candle Gas.

For rail in Scotland, or shipped at Glasgow, Leith, or Granton.

ANALYSIS AND REPORT

ON

CLIMPY TRIPPING COAL,

FOR GAS PURPOSES.

THE results of this analysis, as shown below, were got from actual working, and we have therefore the utmost confidence in placing it, along with that annexed, before you.

COMMERCIAL RESULTS.

Gas per ton of Coal—temperature 60°—barometer 30 inches	10,200 cubic feet.
Coke per ton of Coal	1,400 lbs.
Durability of one cubic foot of the gas, by jet of 5-inch flame	48 min. 24 sec.
Illuminating power in standard candles	14·9

REMARKS.

Being well acquainted with Durham and Northumberland Coals, I have no hesitation in saying that "CLIMPY TRIPPING" is superior to any (containing, besides, a greater proportion of pieces from 7 to 14 lbs. weight), with far less impurities for purification, more gas, and coke equal in calorific power. It has a large mixture of cannel nuts, which accounts for the good quality of the gas, at our photometer in town, 1000 yards from the works.

It is also a very superior Coal for mixing with oils, as by Mackenzie's patent; or with acid tar, or tar oil, shale grease, or other refuse from paraffin-works, as by system of Mr. Scott, of Musselburgh, or Mr. Foster, Portobello, the Coal being easily crushed.

Below are the results realized by myself, when mixed with acid tar from paraffin work, received by me in a solid state, having been run on to very fine dross. My charges were 2 cwt. tripping and 28 lbs. of acid tar, each retort, running six hours; with lighter charges I get more gas, but not so good quality, or so much coke.

Gas per ton of Coal	10,800 cubic feet.
Coke per ton of Coal	1,540 lbs.
Durability of one cubic foot of gas, by jet of 5-inch flame	58 min. 28 sec.
Illuminating power in standard candles	27·29

The first truck received being tried with very light charges (unmixed), and running five hours, I got 10,500 cubic feet of 14-candle gas; and I am confident, practical managers, with good retort-fittings (mine being very inferior), and exhausters at work, as I have seen generally at home and abroad, will take 11,000 feet of 13-candle gas from it. My retorts are 8 feet × 2 feet × 14 inches, D shape, heavy dip, and no exhauster.

These remarks of mine you may perhaps think rather lengthy, but they will be the more intelligible to any manager inquiring for Climpy Tripping.

L. MONK,
Engineer and Manager.

Lanark Gas-Works, April 20, 1874.

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Yields 10,700 cubic feet of 32·77-candle gas per ton, and 9½ cwts. of coke, containing 11 per cent. of ash.

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Yields 12,550 cubic feet of 33-candle gas per ton,
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SILKSTONE COAL COMPANY,
LIMITED,
CAN OFFER A
GAS COAL
Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
Weight of coke in lbs. per ton of coal	1,465

ANALYSIS AND PRICES ON APPLICATION TO
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STRONGLY RECOMMEND A TRIAL OF THEIR
CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

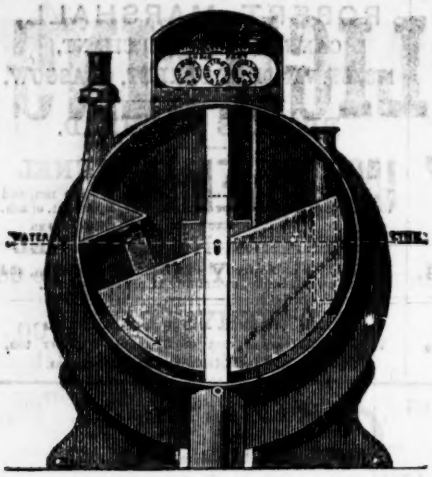
	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.



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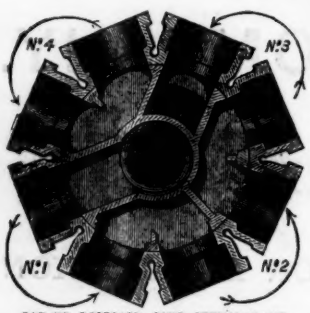

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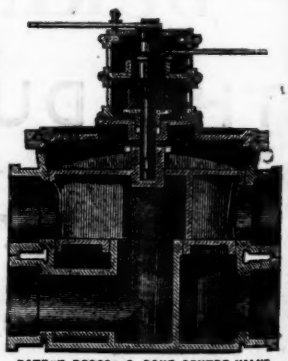

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